

Volume 71 Number 1  
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*Published since 1878*

## **CONTENTS**

Some problems for research in mortality and morbidity . . . <i>Harold F. Dorn.</i>	Page 1
Effects of low-level radioactivity in the Columbia River . . . <i>Croswell Henderson, Gordon G. Robeck, and Ralph C. Palange.</i>	6
An epidemiological approach to traffic accidents . . . . . <i>William G. Beadenkopf, Adde K. Polan, Walter E. Bock, Robert F. Korn, and George James.</i>	15
The state of the Nation's public health services . . . . . Opportunities for nationwide cooperation . . . . . <i>Marion B. Folsom.</i>	25
The wide spectrum of our health services . . . . . <i>Leonard A. Schcele.</i>	26
Current trends in child health . . . . . <i>Martha M. Eliot.</i>	33
Community air pollution, a developing health problem . <i>Justin M. Andrews.</i>	37
Research factors in the control of uterine cancer . . . . . <i>Raymond F. Kaiser.</i>	41
Public health aspects of atomic energy in peacetime . . <i>Daniel Bergsma.</i>	43
The current status of hospital survey and construction programs . . . . . <i>John W. Cronin.</i>	47
Food and drug projects of interest to State health officers . . . . . <i>Jack M. Curtis.</i>	49

Continued ►



## **frontispiece** ---

Collecting mosquitoes in a Trinidad rain forest for the Rockefeller Foundation's virus research program. Photograph from the Rockefeller Foundation Annual Report, 1954.



# CONTENTS *continued*

Willamette Valley chest X-ray survey..... <i>Gordon C. Edwards.</i>	Page 53
Public health awards..... <i>Homer N. Calver.</i>	62
Public health research in chronic disease..... <i>John E. Dunn, Jr.</i>	67
As more people live longer.....	75
Survival of enteric organisms in sea water—A review of the literature..... <i>Arnold E. Greenberg.</i>	77
Measuring reactions to air pollution..... <i>John J. Phair and Maurice L. Thomson.</i>	87
Environmental causes of lung cancer..... <i>W. C. Hueper.</i>	94
Epidemic outbreak of poliomyelitis in Puerto Rico—Pre- liminary report..... <i>Juan A. Pons.</i>	99
Short reports and announcements:	
Poliomyelitis vaccine injections.....	5
Chlortetraeycline as a preservative.....	66
Technical publications.....	74
Federal surplus property.....	76
CDC course in epidemiology for nurses.....	86

## Published concurrently with this issue:

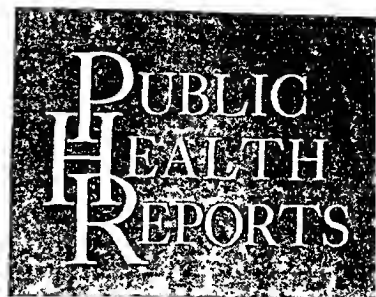
PUBLIC HEALTH MONOGRAPH No. 36 . . . A quest  
into the environmental causes of cancer of the lung.  
*W. C. Hueper.*

54 pages; illustrated. An interpretive article and information on  
availability appear on pages 94-98.

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Volume 71, Number 2

**FEBRUARY 1956**

*Published since 1878*

## **CONTENTS**

Epidemiology of leukemia—PIIR review. . . . .	Page 103
<i>Gilcin F. Meadors.</i>	
Clues to suicide. . . . .	109
<i>Edwin S. Shneidman and Norman L. Farberow.</i>	
Cardiovascular diseases and public health. . . . .	115
<i>John W. Ferree.</i>	
The epidemic climate—PIIR review. . . . .	125
<i>Winston H. Price.</i>	
Unfinished business in maternal and child nutrition. . . . .	139
<i>Marjorie M. Heseltine.</i>	
The use of insecticide treated cords for housefly control. . .	144
<i>John W. Kilpatrick and H. F. Schoof.</i>	
Man's emergence toward health—The C.-E. A. Winslow lecture, 1955. . . . .	151
<i>Henry van Zile Hyde.</i>	
Public health in Pennsylvania. . . . .	160
<i>Berwyn F. Mattison.</i>	
Epidemiological tests of theories on lung cancer etiology. . .	163
<i>William Haenszel.</i>	
Health services in civil defense—A symposium. . . . .	173
Biological-medical considerations in atomic defense. . .	173
<i>Edwin G. Williams and Samuel C. Ingraham II.</i>	
Radiological defense. . . . .	181
<i>Simon Kinsman.</i>	
Chemical weapons. . . . .	184
<i>Harry P. Kramer.</i>	

Continued ►

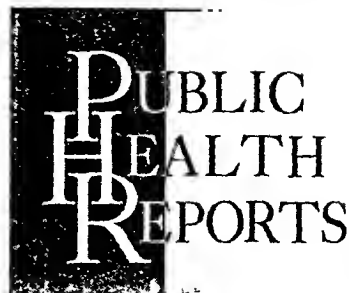
## **frontispiece**

A laboratory technician determines blood-clotting time, information necessary to the safe use of anticoagulant drugs. (See story of the American Heart Association on page 115.)



# CONTENTS *continued*

Health services in civil defense— <i>Continued</i>	Page
Biological hazards . . . . .	186
<i>Theodore J. Bauer.</i>	
Sanitary engineering . . . . .	187
<i>Harry G. Hanson.</i>	
PHS responsibilities . . . . .	190
<i>Leroy E. Burney.</i>	
Tuberculosis morbidity and mortality facts and trends . . .	194
<i>Robert J. Anderson.</i>	
Threshold limit values for 1955 . . . . .	201
Refuse handling practices in the United States . . . . .	204
<i>Malcolm C. Hope, Charles C. Johnson, Jr., and Leo Weaver.</i>	
Short reports and announcements:	
Special assistant for medical affairs . . . . .	114
Back PHR copies, 1952 . . . . .	143
Diabetes control courses in Boston . . . . .	150
Mental health admissions . . . . .	162
Ninth annual seminar on seafood sanitation . . . . .	172
Approval withdrawn for three food dyes . . . . .	193
Armed services medical and dental symposium . . . . .	200



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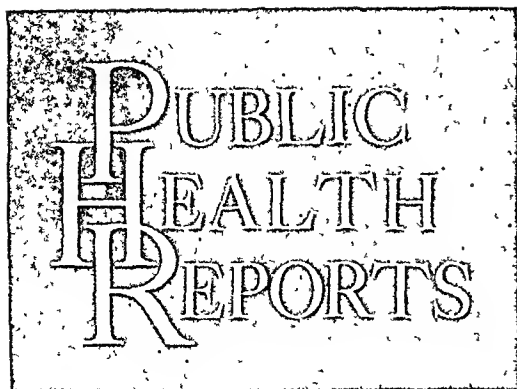
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LEONARD A. SCHEELE, *Surgeon General*



Volume 71, Number 3

**MARCH 1956**

*Published since 1878*

## **CONTENTS**

	<i>Page</i>
Combined efforts stimulate development of rural water systems..... <i>C. H. Weaver, C. T. Roberts, and C. M. Davidson.</i>	209
Mental patient data for fiscal year 1955.....	214
World Health Day, April 7, 1956..... <i>M. G. Candau.</i>	216
Urinary excretion of fluoride following defluoridation of a water supply..... <i>R. C. Likins, F. J. McClure, and A. C. Steere.</i>	217
APIIA conference report, 1955—A special section:	
Where are we going in public health?.....	221
List of sections and affiliated organizations.....	222
Goals and issues.....	223
World health.....	229
Laboratory developments.....	235
Medical economics.....	240
Service statistics.....	250
Planning and management.....	250
Professional education, training.....	257
Child health services.....	260
Accidental poisoning.....	266
Mental health research.....	270
School health practices.....	275

Continued ►



### **frontispiece**

Recently completed Entomological Research Center of the Florida State Board of Health at Vero Beach, Fla.

# CONTENTS *continued*

	<i>Page</i>
Dental care and services.....	280
Epidemiology.....	282
The virus diseases.....	284
Poliomyelitis.....	288
Tuberculosis.....	290
Rheumatic fever.....	292
Studies in zoonoses.....	293
Environmental health.....	299
Radiological health.....	302
Milk, fish, fruit juice tests.....	305
Water quality tests.....	307
Vital statistics.....	309
Public health nursing.....	312
Physician distribution.....	315
Trends in nutrition.....	317
Health services for migrants.....	321
Health education workshop.....	322
Military public health.....	325
Milk sanitation honor role for 1954-1955.....	327
Short reports and announcements:	
1955 water supply inventory.....	213
International symposium on venereal disease.....	330



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# PUBLIC HEALTH REPORTS

Volume 71, Number 4

**APRIL 1956**

*Published since 1878*

## **CONTENTS**

Ultraviolet sterilization in microbiological laboratories.....	Page 331
<i>Arnold G. Wedum, Everett Hanel, Jr., and G. Briggs Phillips.</i>	
State grants for local projects in chronic illness control.....	337
<i>A. L. Chapman and Daniel Bergsma.</i>	
Environmental health program and budget in local health departments, 1954.....	340
Infectious hepatitis epidemic in a mental hospital.....	345
<i>Otto L. Bettag, Frederick Plotke, Werner Tuteur, and Gudrun Herborn.</i>	
A patients' opinion survey at Firland Sanatorium.....	351
<i>Catherine E. Vavra and Edith Dyer Rainboth.</i>	
Sanitation of domestic airlines.....	360
<i>William H. Megonnell and Howard W. Chapman.</i>	
Third antibiotics symposium—Abstracts of 14 papers.....	369
Estella Ford Warner retires.....	375
<i>Leonard A. Scheele.</i>	
Why people seek diagnostic X-rays.....	377
<i>Godfrey M. Hochbaum.</i>	
Veneral disease control in New York City.....	381
<i>Theodore Rosenthal and Jules E. Vandow.</i>	
A pre-administration curriculum in a school of public health.	391
<i>Keith O. Taylor.</i>	
Poliomyelitis survey in Rio de Janeiro.....	395
<i>Mauricio Martins da Silva and Jerome T. Syverton.</i>	

Continued ►

## **frontispiece**

Training and organization are the primary concern of Iraq's health program. With American assistance Iraqis will get valuable training for the jobs that face them. See page 417.



	<i>Page</i>
Appraising cancer nursing services—A study to establish criteria.....	399
<i>E. Dorothy Gordon, Vincent H. Handy, Frances Titus, and Earle G. Brown.</i>	
Malaria control in Turkey.....	409
<i>Frederick W. Kratz and C. Bradley Bridges.</i>	
The United States-Iraq cooperative health program.....	417
<i>Glenn S. Usher.</i>	
Short reports and announcements:	
Methodology research award.....	336
Legal note—Constitutionality of temporary committal of the mentally ill.....	344
Uterine cancer detection studies.....	359
PHS staff announcement.....	368
Medical review bibliography.....	374
On rehabilitation.....	376
Legal note—Pathological and laboratory services to hospital patients in Iowa.....	380
Project to combat tuberculosis in Indians.....	394
Idea—Modified oscilloscope.....	408
Mental defectives and epileptics in public institutions..	416
Technical publications.....	424



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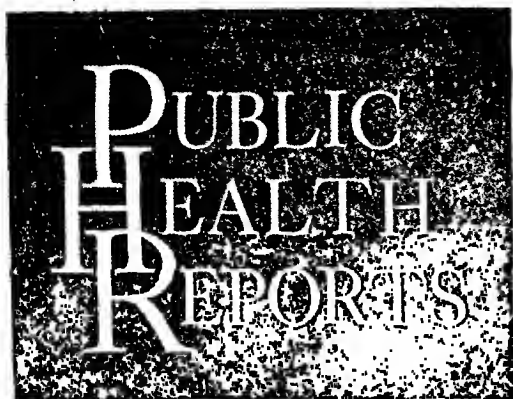
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Volume 71, Number 5

**MAY 1956**

*Published since 1878*

## **CONTENTS**

	<i>Page</i>
Cardiovascular disease programs for the community—PHR review . . . . .	425
<i>William J. Zukel, Herman E. Hilleboe, and Joseph T. Doyle.</i>	
Dynamic impact of advancing technology on environment and health . . . . .	436
<i>Mark D. Hollis.</i>	
What is happening to sponsored training for nurses? . . . . .	441
<i>Donna Pearce.</i>	
Association of vitamin B <sub>6</sub> deficiency with convulsions in infants . . . . .	445
<i>E. M. Nelson.</i>	
Protect your family against poisoning . . . . .	450
<i>Irvin Kerlan.</i>	
California's chronic disease activities . . . . .	453
<i>Lester Breslow, Nancy Ott, and Vivian Chin.</i>	
Acute and subacute toxicity studies of sodium fluoride in animals . . . . .	459
<i>Nicholas C. Leone, Erving F. Geever, and Neil C. Moran.</i>	
Accident prevention in sanitation . . . . .	468
<i>Edgar F. Seagle.</i>	
Development of a poultry ordinance . . . . .	471
<i>Joe W. Atkinson.</i>	

Continued ►

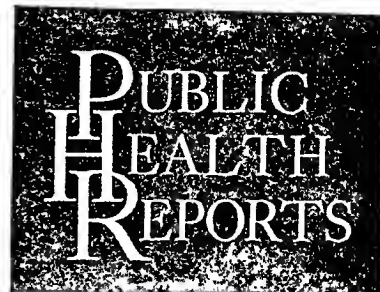


### **frontispiece**

Prevention of home accidents strikes at a common killer of children. The little girl playing with matches, photographed by Dr. Charles M. Cameron, Jr., illustrates one type of hazard. A leaflet on accidental poisoning is described on pages 450-452.



Extending voluntary health insurance through community organization.....	477
<i>Donald G. Hay and Selz C. Mayo.</i>	
Continued high incidence of diphtheria in a well-immunized community.....	481
<i>W. J. Murphy, V. Hamilton Maley, and Lillian Dick.</i>	
Nutritional knowledge and practices.....	487
<i>Charlotte M. Young, Kathleen Berresford, and Betty Greer Waldner.</i>	
Repeated pregnancy wastage.....	493
<i>F. J. Schoeneck.</i>	
Cancer in Iowa.....	495
Soil nitrification and nitrates in waters.....	497
<i>Edwin L. Schmidt.</i>	
The behavioral sciences and the professions.....	504
<i>David G. French.</i>	
Trends in brucellosis control.....	511
<i>K. F. Meyer.</i>	
Short reports and announcements:	
Change in name of institute.....	435
Research in hospital facilities field.....	440
OVR appoints advisers on training policy.....	444
PIIS films.....	449
Inventory of water needs.....	467
Galactosemia cause found.....	470
Technical publications.....	476
Warns against Hoxsey treatment.....	486
Legal note—Fluoridation of public water supplies....	503
Application deadlines waived.....	510
<i>Published concurrently with this issue:</i>	
PUBLIC HEALTH MONOGRAPH No. 37 ... Cancer morbidity in urban and rural Iowa.	
<i>William Haenszel, Samuel C. Marcus, and Edmund G. Zimmerer.</i>	
85 pages; illustrated. A summary and information on availability appear on pages 495-496.	



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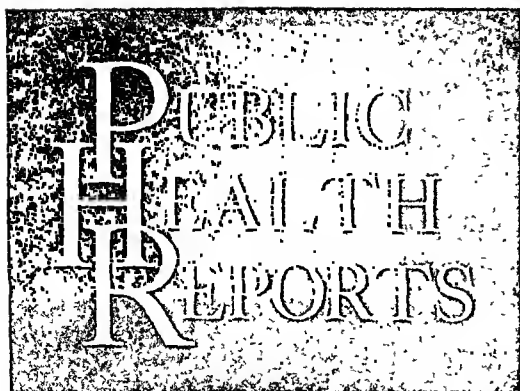
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Volume 71, Number 6

**JUNE 1956**

*Published since 1878*

## **CONTENTS**

	<i>Page</i>
Service statistics in public health.....	519
Basic principles governing service statistics in public health..	521
Evaluation in public health—Conference report.....	525
Practical nurse training in the home—Montefiore demonstra- tion project.....	530
<i>Martin Cherkasky, Elizabeth B. Torrance, Elsie Bandman, and Betty Seifman.</i>	
Unknowns and enigmas in gonorrhea.....	537
<i>Ira Leo Schamberg.</i>	
Variation in mortality from heart disease—Race, sex, and socioeconomic status.....	545
<i>Abraham M. Lilienfeld.</i>	
Sewage disposal in mass building.....	553
<i>David B. Lee.</i>	
50 years of food and drug protection.....	557
<i>George P. Larrick.</i>	
Significant dates in food and drug law history.....	558
Food sanitation.....	560
<i>Glenn G. Slocum.</i>	
FDA nutrition program.....	566
<i>E. M. Nelson.</i>	
New problems of food safety.....	571
<i>Frank A. Vorhes and Arnold J. Lehman.</i>	

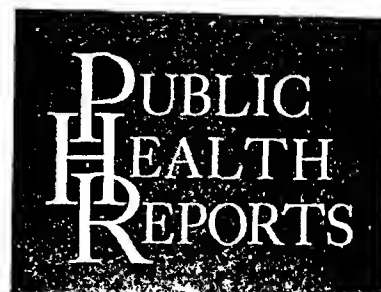
Continued ►

## **frontispiece**

Drs. Wiley, Alsberg, and Browne were chiefs of the Bureau of Chemistry, Department of Agriculture, and administered the Federal food and drug programs before the Food and Drug Administration was created in 1927. The others shown served as heads of the new Federal agency. See special section, pages 557-603.



Control of pesticides on food.....	577
<i>Winton B. Rankin.</i>	
Certification of coal-tar colors.....	581
<i>G. Robert Clark.</i>	
Drugs and medical devices.....	587
<i>Albert H. Holland, Jr.</i>	
Assuring the safety of new drugs.....	590
<i>Ralph C. Smith.</i>	
Certification of antibiotics.....	594
<i>Henry Welch.</i>	
Certification of insulin.....	600
<i>R. Lorimer Grant.</i>	
Poliomyelitis vaccine studies.....	604
<i>Gordon C. Brown, Alan S. Rabson, and Donald E. Craig.</i>	
Hospital problems of mass evacuation.....	612
<i>Harold M. Erickson.</i>	
The biology of northern mosquitoes.....	616
<i>W. C. Frohne.</i>	
No single blueprint but a common pattern for community organization of health services—Conference report, National Committee on Local Health Departments.....	623
Oral health study in children of suburban Washington, D.C... ..	626
<i>A. L. Russell.</i>	
Short reports and announcements:	
Joint services sanitary engineering training courses....	536
CDC laboratory refresher training courses.....	544
Fourth annual symposium on antibiotics.....	570
Research in cancer chemotherapy.....	580
Changing drug picture.....	603
Increase in nuclear reactors.....	611
Idea—Piggybank blood testing.....	622
Technical publications.....	625



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# PUBLIC HEALTH REPORTS

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**JULY 1956**

*Published since 1878*

## CONTENTS

	Page
Tuberculin sensitivity of young adults in the United States..... <i>Carroll E. Palmer, Edward F. Krohn, Nicholas E. Manos, and Lydia B. Edwards.</i>	633
A backdrop of facts on patients and their care in proprietary nursing homes..... <i>Jerry Solon.</i>	646
Effect of fluoridated public water supplies on dental caries prevalence—Tenth year of the Grand Rapids-Muskegon study..... <i>Francis A. Arnold, H. Trendley Dean, Philip Jay, and John W. Knutson.</i>	652
Microbiological safety..... <i>Morton Reitman and A. G. Wedum.</i>	659
Changing the priorities in public health..... <i>George James.</i>	666
Jones criteria (modified) for guidance in the diagnosis of rheumatic fever.....	672
National health forum on chronic illness—National health Council. Nine briefs..... Five million people, <i>Leonard W. Mayo</i> . . . Public programs, <i>Lowell T. Coggeshall</i> . . . Preventive action, <i>Lester Breslow</i> . . . National health trends, <i>Charles I. Schottland</i> . . . Illness absenteeism, <i>Gerhard Hirschfeld</i> . . . Chronic disease services, <i>G. D. Carlyle Thompson</i> . . . Suggestions and predictions, <i>C. Rufus Rorem</i> . . . Meeting the costs, <i>I. Jay Brightman</i> . . . A call for action, <i>Morton L. Levin.</i>	675

Continued ►

### frontispiece

A Public Health Service officer tells a group of Liberians about a vaccination they are to receive. A new filmstrip depicts PHS commissioned corps activities (see p. 697).



# CONTENTS *continued*

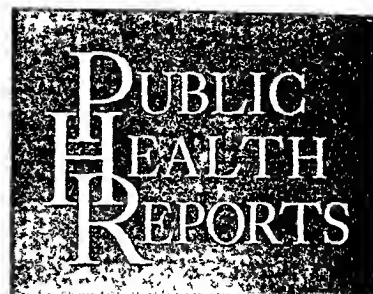
Service with distinction—A pictorial story of the Public Health Service.....	697
Variations on the theme mental health in nursing..... <i>Ruth E. Simonson.</i>	700
Health supervision of infants and preschool children— Service statistics.....	705
Stream enrichment and microbiota. <i>James B. Lackey.</i>	708
Diagnosis of psittacosis in parakeets <i>R. E. Kissling, M. Schaeffer, O. K. Fletcher, D. D. Stamm, M. A. Bucca, and M. M. Sigel.</i>	719
Surgical experience in selected areas of the United States	725
Short reports and announcements:	
PHS films.....	658
New members of PHR Board of Editors.	704
Air pollution research.....	718
Increase in juvenile delinquency.	724
Technical publications.	726

## *Published concurrently with this issue:*

PUBLIC HEALTH MONOGRAPH No. 38 . . . Surgical experience in selected areas of the United States.

*Selwyn D. Collins, Josephine L. Lehmann, and Katharine S. Trantham.*

48 pages; illustrated. A summary and information on availability appear on page 725.



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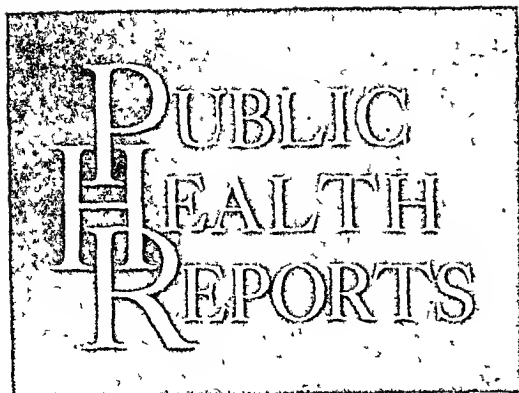
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AUG 23 1956

Volume 71, Number 8

AUGUST 1956

Published since 1878 AUG 23 1956

## CONTENTS

	Page
Nurses for alcoholics..... <i>Giorgio Lolli.</i>	727
Costs of care of aged and infirm residents in Florida nursing and boarding homes..... <i>Ferne Hobson Britt and Margaret H. Jacks.</i>	735
Heart disease at mid-century..... <i>Paul D. White.</i>	742
Group A beta hemolytic streptococcus and rheumatic fever in Miami, Fla.—8-month bacteriological and serologic study..... <i>Murray M. Streitfeld, Milton S. Saslaw, and Simon D. Doff.</i>	745
LePrince, malaria fighter.....	756
Mosquitoes and encephalitis in the irrigated High Plains of Texas..... <i>Fred C. Harmston, George R. Shultz, Richard B. Eads, and George C. Menzies.</i>	759
Urinary fluoride levels associated with use of fluoridated waters..... <i>I. Zipkin, R. C. Likins, F. J. McClure, and A. C. Steere.</i>	767
Smoked fish as a vehicle of salmonellosis..... <i>I. Olitzky, A. M. Perri, M. A. Shiffman, and M. Werrin.</i>	773
The use of a series of TV programs to educate parents in child care..... <i>Anne B. Wagner and Mary Ellen Patno.</i>	780
Fly production in treated and untreated privies..... <i>John W. Kilpatrick and H. F. Schoof.</i>	787
1955 summary of disease outbreaks..... <i>Carl C. Dauer and Granville Sylvester.</i>	797

Continued ►

## frontispiece

For the story of the late Joseph A. A. LePrince (1875–1956), a pioneer in the fight against malaria and yellow fever and a veteran campaigner against other tropical diseases, see page 756.



# CONTENTS *continued*

Public health—community wealth—APHA Southern Branch conference report.....	804
The sanitary engineer in hurricane floods.....	814
<i>Frank Tetzlaff, K. C. Lauster, and Richard S. Mark.</i>	
Health activities to combat flood damage—Bucks County, Pa., experience.....	821
<i>Melvina F. Palmer.</i>	
Histoplasmosis conference.....	825
<i>Michael L. Furcolow.</i>	
✓ Sampling plan for a small household survey.....	827
Problems in the use of tranquilizing drugs.....	830
Short reports and announcements:	
Staff college course for nurses.....	744
Departmental announcement.....	755
Training in insect and rodent control.....	758
Surgeon General Scheele resigns.....	779
Auxiliary publication.....	803
Course in laboratory diagnosis of tuberculosis.....	812
Technical publications.....	813
Insured group medical care.....	820
Advisory committee on Indian health.....	826
Institutes in the care of premature infants.....	829
Advisory council on vocational rehabilitation.....	832

## *Published concurrently with this issue*

PUBLIC HEALTH MONOGRAPH No. 39 . . . Proceedings of the conference on histoplasmosis.

322 pages; illustrated. A summary and information on availability appear on pages 825-826.

PUBLIC HEALTH MONOGRAPH No. 40 . . . Sampling methods for a small household survey.

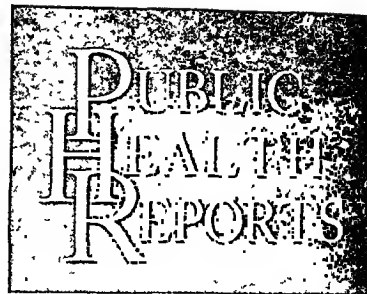
*Theodore D. Woolsey.*

16 pages; illustrated. A summary and information on availability appear on pages 827-829.

PUBLIC HEALTH MONOGRAPH No. 41 . . . Public health and social problems in the use of the tranquilizing drugs.

*Morton Kramer.*

32 pages; illustrated. A summary and information on availability appear on pages 830-832.



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Volume 71, Number 9

SEPTEMBER 1956

Published since 1878

## CONTENTS

	Page
Cooperation between departments of health and welfare... <i>Jonas N. Muller and Pearl Bierman.</i>	833
Geographic patterns in deaths from coronary heart disease... <i>Philip E. Enterline and William H. Stewart.</i>	849
An outbreak of shigella gastroenteritis..... <i>Martin D. Keller and Malcolm L. Robbins.</i>	856
Survey of general hospitals accepting mental patients..... <i>Bernard H. Kroll and Hyman Goldstein.</i>	863
Performance budgeting for the health department... <i>Daniel Klepak.</i>	868
Insecticide resistance of <i>A. quadrimaculatus</i> in Bolivar County, Miss..... <i>Willis Mathis, H. F. Schoof, Kenneth D. Quarterman, and Richard W. Fay.</i>	876
Queens rehabilitation program for handicapped children... <i>Leonard W. Mayo and Robert M. Webb.</i>	879
Tuberculosis: hospital or home care. Papers selected from the joint annual meetings of the National Tuberculosis Association, American Trudeau Society, and National Conference of Tuberculosis Workers.....	887
The nonhospitalized tuberculosis patient—Program implications..... <i>Robert J. Anderson, Herbert I. Sauer, Verna Smith,     and Doris E. Roberts.</i>	888
The social significance of chronic illness..... <i>Lucille M. Smith.</i>	896
Patients who disregard medical recommendations— Brief..... <i>Ruth B. Taylor.</i>	904



Continued ▼

### frontispiece

Harry's story is the story of some 200 other handicapped children in the Queens Rehabilitation Program described on p. 879.



Tuberculosis: hospital or home care—Continued	Page
Pulmonary nodules found in Cleveland survey—Brief. . <i>Sabine M. Holin, Ralph E. Dwork, Stanley Glaser,         Arthur E. Rikli, and Joseph B. Stocklen.</i>	907
Abstracts of 10 other papers.....	908
Health services for children of school age.....	917
Some basic principles and problems of air sampling in industry..... <i>Charles D. Yaffe.</i>	923
Hospital and medical facilities survey and construction program..... <i>John W. Cronin.</i>	932
Food poisoning caused by the great barracuda..... <i>Sidney Paetro.</i>	933
Infectious hepatitis, diarrhea, and typhoid fever—Epidemiological study in Washington, D. C., 1954-55..... <i>Gilbert V. Levin and Howard West.</i>	938
Sanitary engineering degrees awarded in 1955..... <i>Edmund J. Laubusch and Harvey F. Ludwig.</i>	945
Milk sanitation honor roll for 1954-56.....	947
Child guidance clinic policy and practices.....	951
Experimental approach to DDT toxicity.....	953
Short reports and announcements:	
Facilities for research in health related sciences.....	837
Nine grants for hospital research.....	841
Auxiliary publication.....	848
Surgeon General Burney.....	886
Confirm efficacy of salt and soda solution.....	952
Technical publications.....	954

*Published concurrently with this issue:*

PUBLIC HEALTH MONOGRAPH No. 42 . . . Some aspects of child guidance clinic intake policy and practices.

*Forrest N. Anderson and Helen C. Dean.*

16 pages. A summary and information on availability appear on page 951.

PUBLIC HEALTH MONOGRAPH No. 43 . . . DDT in the diet of the rat.

*Paul Ortega, Wayland J. Hayes, Jr., William F. Durham, and Arnold Mattson.*

27 pages; illustrated. A summary and information on availability appear on page 953.

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Volume 71, Number 10

**OCTOBER 1956**

*Published since 1878*

## **CONTENTS**

	Page
Nerve gas in public water..... <i>Joseph Epstein.</i>	955
Present status of controlled fluoridation in the United States.....	963
Analysis of a hospital consultation program..... <i>Helen M. Wallace, Margaret A. Losty, Robert S. Siffert, Jerome S. Tobis, and Miriam Lending.</i>	967
Chelation as a method for maintaining the coliform index in water samples..... <i>E. L. Shipe, Jr., and Adelaide Fields.</i>	974
Susceptibility of New Mexico rodents to experimental plague..... <i>R. Holdenried and S. F. Quan.</i>	979
General hospital and nursing home beds in urban and rural areas..... <i>Jerry Solon and Anna Mae Baney.</i>	985
Progress and potentials in leprosy research—Abstracts of a conference on leprosy held at Carville, La.....	993
Public health begins in the family..... <i>Halbert L. Dunn and Mort Gilbert.</i>	1002
The family—A focal point in health education. Nine briefs..... Evolution of the character of family life education, <i>Wallace C. Fulton</i> . . . Changing family profile, <i>Edward A. Lew</i> . . . Psychological dynamics of the familial organism, <i>Nathan W. Ackerman</i> . . . Family health maintenance, <i>George A. Silver</i> . . . The physician and the family, <i>Duncan W.</i>	1011



Continued ►

## **frontispiece**

The Mayo Memorial at the University of Minnesota, Minneapolis, houses facilities for the Schools of Public Health and Medicine (see story on page 962).

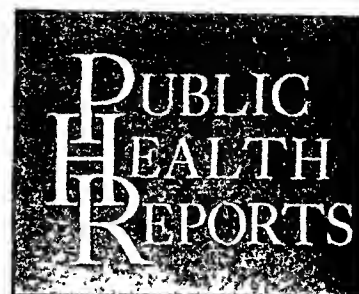
	Page
<i>Clark . . . Education for parenthood, Hazel Corbin . . . Culture and health practice, Martin K. Opler . . . An approach to the study of family mental health, Gerald Caplan . . . Social work for the family, Virginia Bellsmith.</i>	
Public Health Service announces new program for accident prevention.....	1032
Progress in reporting mental hospital statistics—Sixth Annual Conference of Mental Hospital Statisticians.....	1033
California's experience in training public health physicians. <i>George T. Palmer and Malcolm H. Merrill.</i>	1037
Etiology of 1954-55 poliomyelitis epidemic in Puerto Rico.. <i>David H. Naimark and Nancy G. Rogers.</i>	1041
Some statistical aspects of safety testing for the Salk poliomyelitis vaccine.....	1045
<i>Jerome Cornfield, Max Halperin, and Felix Moore.</i>	
Recent studies in surface disinfection—PHR review.....	1057
<i>R. L. Stedman and E. Kravitz.</i>	
Short reports and announcements:	
The Mayo Memorial.....	962
Engineering abstracts on sale .....	966
NRC medical research fellowships.....	973
Grants-in-aid for training in air pollution control.. .	1001
PHS staff announcements.....	1031
Home safety inventory.....	1036
National Advisory Council on Health Research Facilities .....	1044
Shellfish sanitation workshop.....	1064

*Published concurrently with this issue:*

PUBLIC HEALTH MONOGRAPH No. 41. . . . General hospitals and nursing homes: Patterns and relationships in their geographic distribution.

*Jerry Solon and Anna Mae Baney.*

56 pages; illustrated. A companion article and information on availability appear on pages 985-992.



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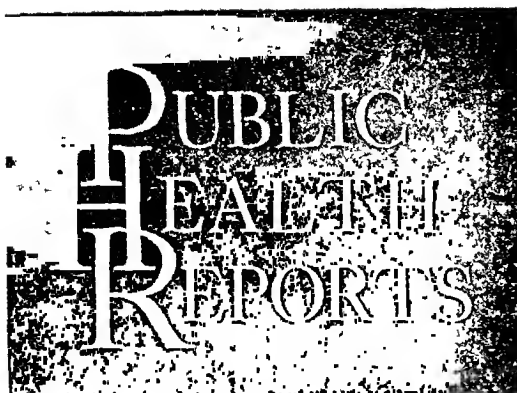
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Volume 71, Number 11

**NOVEMBER 1956**

*Published since 1878*

## **CONTENTS**

	<i>Page</i>
A scientific approach to fetal wastage in Halifax County, North Carolina.....	1065
<i>Robert F. Young.</i>	
Legislation on air pollution.....	1069
<i>Frederick S. Mallett.</i>	
Group therapy behind locked doors.....	1075
<i>Seymour Rubenfeld, Robert Shellow, and Jack L. Ward.</i>	
Causes of deaths among college students—A study of 209 deaths at Yale University, 1920-55.....	1081
<i>Henry M. Parrish.</i>	
Cherokee Indian health survey.....	1086
<i>Charles M. Cameron, Jr.</i>	
Serologic survey for syphilis in migratory labor camps of upstate New York.....	1089
<i>Evan W. Thomas and Joseph Giordano.</i>	
The use of the membrane filter technique for testing water supplies in the field.....	1093
<i>Malcolm C. Hope and Arthur H. Neill.</i>	
Tuberculosis disinfection with diamine.....	1097
<i>Anson Hoyt, Arthur H. K. DJang, and C. Richard Smith.</i>	
Death certificate statement of occupation: Its usefulness in comparing mortalities.....	1105
<i>Robert Buechley, John E. Dunn, Jr., George Linden, and Lester Breslow.</i>	
Effects of penicillin G in vitro on <i>Hemophilus ducreyi</i> .....	1112
<i>Solomon Singer and Wilbur E. Deacon.</i>	



Continued ►

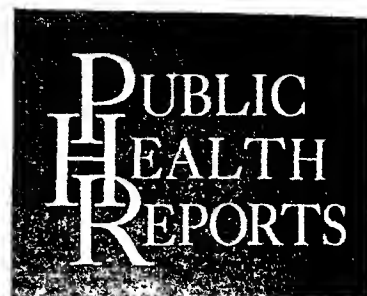
Disability in Butler County, Pennsylvania.....	Page 1115
<i>Saxon Graham.</i>	
Distribution of toxoplasma antibodies in comparable urban and rural groups.....	1119
<i>Colvin L. Gibson.</i>	
Organic contaminants affecting the quality of water.....	1125
<i>F. M. Middleton and A. A. Rosen.</i>	
A survey of tobacco smoking patterns in the United States .	1134
The nationwide fight against blindness... ..	1137
<i>Franklin M. Foote.</i>	
Speed zone epidemiology: A preliminary report on benza- thine penicillin G for gonorrhea in women.....	1142
<i>Carl E. Hookings and L. M. Graves.</i>	
Report on barbiturates. The New York Academy of Medicine.....	1144
Short reports and announcements:	
Mintener resigns.....	1074
PHS films.....	1080
Porterfield named assistant to the Surgeon General...	1085
Tranquilizing drug research.....	1092
Public health training program.....	1096
Record number rehabilitated.....	1103
Public health nurses in Israel.....	1104
Dental manpower resources.....	1123
International mail pouch.....	1124
Technical publications.....	1133
Air pollution demonstration projects.....	1141

*Published concurrently with this issue:*

PUBLIC HEALTH MONOGRAPH No. 45 . . . Tobacco smoking  
patterns in the United States.

*William Haenszel, Michael B. Shimkin, and Herman  
P. Miller.*

111 pages; illustrated. A summary and information on availability appear  
on pages 1134-1136.



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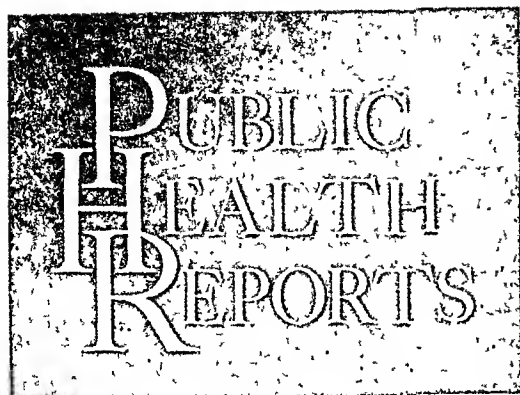
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Volume 71, Number 12

**DECEMBER 1956**

*Published since 1878*

## **CONTENTS**

	<i>Page</i>
Proprieties of tuberculosis management . . . . . <i>W. M. Peck.</i>	1159
The National Library of Medicine . . . . .	1164
Selected papers of Joseph W. Mountin . . . . . <i>E. G. McGarran.</i>	1166
Programs for the aged . . . . . <i>Leroy E. Burney.</i>	1168
Trends in gerontology . . . . . <i>William B. Kountz.</i>	1170
Psychological limitations that occur with age, . . . . . <i>James E. Birren.</i>	1173
Changes in nervous system with age . . . . . <i>Harry H. Wilcox.</i>	1179
Physiological limitations and age . . . . . <i>Joseph A. Falzone, Jr., and Nathan W. Shock.</i>	1185
Restorative services for older people . . . . .	1194
Age changes and employability . . . . . <i>L. F. Koyl.</i>	1195
Workshops and seminars—University of Michigan Conference on Aging . . . . .	1203

Continued ►



## **frontispiece**

Almost 1,000 years ago, Avicenna (980–1037), the wise physician-philosopher, anticipated today's concern with geriatrics. His great Canon discusses the nutritional, mental, and physical needs of the aging. (Picture courtesy of Iranian Embassy.)

	<i>Page</i>
Toward improved health for the aging—Federal-State Conference on Aging . . . . .	1209
Rural health survey of men over forty . . . . . <i>John Pemberton and Kenneth I. E. Macleod.</i>	1213
Blindness among the aged . . . . . <i>Nedra B. Belloc.</i>	1221
Occurrence of influenza, July 1955 to June 1956 . . . . . <i>Dorland J. Davis.</i>	1226
Clinical and roentgenographic examinations for dental caries in Grand Rapids, Mich. . . . . <i>Richard L. Hayes, H. Berton McCauley, and Francis A. Arnold, Jr.</i>	1228
United States-Mexico Border Public Health Association— Conference report . . . . .	1237
Evaluating bacterial contamination in sea water samples . . <i>Gerald T. Orlob.</i>	1246
Short reports and announcements:	
Federal Water Pollution Control Act of 1956 . . . . .	1163
Directs program on aging . . . . .	1172
Making health visible . . . . .	1178
Film: Still going places . . . . .	1202
Reading list on aging . . . . .	1208
Center for aging research . . . . .	1220
Glaucoma after forty . . . . .	1225
Back numbers of PHR . . . . .	1236
PHS staff appointments . . . . .	1245
Technical publications . . . . .	1252



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*Relationships of health to demographic characteristics warrant further examination and study in the United States.*

## Some Problems for Research in Mortality and Morbidity

By HAROLD F. DORN, Ph.D.

THE COLLECTION, compilation, and publication of vital statistics are among the major activities of every public health agency. Too frequently the collection and preparation for publication of vital statistics require such a large proportion of the time and energy of available personnel that the analysis and interpretation of these data are neglected. Yet without analysis and interpretation, vital statistics remain relatively sterile.

Nearly a century ago the great English vital statistician, William Farr, began his analysis of official mortality records in order to discover and point out significant variations in ill health among various groups of the population. The work he initiated has been continued and expanded by succeeding registrars general. The most extensive information concerning variations in mortality rates by occupation and socioeconomic classes available anywhere is that for England and Wales.

The United States does not have a series of analyses of mortality statistics comparable to those of England and Wales. The first third of

this century was devoted to establishing a complete registration system covering the entire United States. Mortality and natality statistics for the entire country first became available in 1933.

A test of birth registration completeness made at the time of the 1950 census of population revealed that a birth certificate was on file for 98.6 percent of white infants and for 93.5 percent of nonwhite infants born during the first quarter of 1950.

Although a comprehensive study of the completeness of death registration has never been made, the relative amount of under-registration probably is negligible except for some rural areas whose aggregate population is not large. The relative amount of under-registration of infant deaths may be somewhat greater than that for deaths of persons aged 1 year or older. In computing the 1939-41 life tables, the National Office of Vital Statistics assumed that the relative under-registration of infant deaths was approximately equal to that of births. However, this assumption has never been tested by an actual field study.

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### Rural and Urban Differences in Mortality

One of the first illustrations of mortality differences in medical literature was the higher death rate among city dwellers in contrast to rural residents. Although this difference gen-



erally is assumed to exist at the present time, no comprehensive study of the problem has been made in recent years.

Mortality statistics classified by the place of residence of the deceased were first published by age, sex, race, and size of community for deaths occurring in 1940. These were available for each State for all causes combined and for a limited number of important causes for both sexes combined for the entire United States. A supplementary volume (1) presented data for the 2-year period, 1939-40, for each city of 100,000 or more population, by leading causes of death, age, and race and for each county and city of 10,000 or more population for all causes. By the time these data were published in 1943, World War II was in progress so that a systematic analysis of the 1940 mortality tabulations was not conducted.

Two important changes affecting the use of mortality statistics were introduced in the 1950 census of population: the change in the definition of the urban population to include the urban fringe of cities of 50,000 or more population and the delineation of standard metropolitan areas and standard economic areas and regions. Prior to and including 1930, urban was defined as places of 10,000 or more inhabitants in the tabulation of vital statistics, a definition that did not correspond to that used in the census of population from 1910 to 1940. In 1940, for the first time, a comparable definition of urban and rural population was used for both the enumeration of population and the tabulation of vital statistics. No practicable way of classifying vital statistics in accordance with the revised definition of urban population used in the 1950 census has yet been devised, so once again it appears that the definition of the urban population may not be the same for the two sets of statistics.

Fortunately, a reasonably satisfactory substitute for the rural-urban classification is available. Since 1950, the National Office of Vital Statistics has tabulated mortality statistics for the metropolitan and nonmetropolitan counties of each State. In general, metropolitan counties are the counties included in the standard metropolitan areas used by the Bureau of the Census. No extensive analysis of these statistics has yet been published.

## Geographic Variations in Mortality

Almost a century ago, William Farr proposed that the healthiest districts of England and Wales be used as a yardstick of public health. From time to time since then, the registrar general has used this concept in the presentation and analysis of mortality data. In contrast, very little has been published in the United States concerning geographic variations in mortality rates. The range between the States with the highest and lowest mortality rates probably has been decreasing. Nevertheless, in 1950, after adjusting for differences in the age composition of the population, the highest rate still was 40 percent above the lowest rate.

State death rates by age vary much more than the average rate for all ages. For the white population in 1950, the highest rates for each age group under 55 years were approximately twice as large as the lowest rates. Above this age the range in death rates is smaller but still averages about 50 percent.

The range between the highest and lowest death rates almost certainly would be greater for areas smaller than States. The county is the preferable unit for forming such areas since the basic demographic data are available for counties and since the allocation of deaths to county of residence undoubtedly is more reliable than the allocation to rural or urban areas.

Two groupings of counties suggest themselves: metropolitan and nonmetropolitan counties within each State and the State economic areas or subregions defined by the Bureau of the Census in cooperation with other agencies. The economic subregions, although they cross State boundaries, are probably the most useful grouping of counties for the study of geographic differences in mortality rates. As no tabulation of mortality data by economic subregions has been made, a complete retabulation for one or more years around 1950 would be required.

## Mortality by Occupation

The 14th Annual Report of the Registrar General of England and Wales for 1851 contained a tabulation of the deaths of males, aged 20 years or more, classified by the occupation of

the deceased. This was the first of a series of decennial reports that has been continued for 100 years. Shortly after the death registration area was established in the United States, plans were made for a study of occupational mortality around the date of the 1910 census. The 1909 volume of mortality statistics contains tables giving the number of deaths of males classified by age, occupation and cause of death. No data were published for subsequent years and so far as I can determine no analysis was ever made. A special tabulation of the census population by occupation would have been required since the death registration States of 1910 included only 51 percent of the total population of the United States.

The many discussions of the relationship of mortality rates to occupational and socioeconomic groups that have taken place in the United States since 1910 have produced few statistics. The National Tuberculosis Association published a brief analysis of mortality rates for 7 broad social and occupational classes, based upon the deaths of male workers in 10 States during 1930. Except for this study, no analysis of mortality differences among occupational or socioeconomic groups based upon official death statistics has been made in the United States.

One of the major deterrents to a study of occupational mortality has been uncertainty concerning the degree of comparability of the entries of occupation and industry on death certificates with those on the census of population schedules. A corresponding uncertainty also has prevented the analysis of official birth statistics by occupational or socioeconomic groups.

Fortunately, studies are now under way to resolve this difficulty. The Scripps Foundation in cooperation with the Bureau of the Census is planning to compare the entries for occupation and industry on a sample of birth and death certificates with corresponding information from the 1950 census schedules. In the meantime, the National Office of Vital Statistics is preparing an analysis of mortality differentials by occupation and socioeconomic class based on deaths of males from 20 to 65 years of age during 1950. The successful completion of these two projects will provide a basis for planning future studies of the relationship of mor-

tality and fertility to occupational and socioeconomic classes in the United States.

### Fetal Mortality

The rapid decline in the infant mortality rate has led some to assume that mortality during the first few months of life is now under control and that it is only a question of time until the death rate at the start of life will be lowered to the irreducible minimum. This is far from being the case. The high infant mortality rates of the past have distracted attention from the even higher fetal mortality rate. In addition, the reporting of fetal deaths has been so incomplete that a reliable estimate of fetal mortality could not be made.

In the United States, New York City probably has the longest record of registration of all fetal deaths regardless of the duration of pregnancy. In 1900 the reported infant mortality rate for New York City was 135 per 1,000 live births, and the reported fetal death rate was 45 per 1,000 live births plus fetal deaths. In 1953 the corresponding rates were 24 and 107 respectively. The increase in the fetal death rate from 45 to 107 per 1,000 probably is largely the result of improved reporting and the revision of regulations to specify more clearly that all fetal deaths, irrespective of the period of gestation, should be reported.

Registration still is seriously incomplete; during the 5 years from 1949 to 1953 the fetal death rate in New York City increased from 84 to 107 or about 27 percent. Studies of selected groups of pregnant women indicate that perhaps as many as one-half of the total fetal deaths are not reported. If generally true, this conclusion leads to an estimate that approximately 20 percent of pregnancies in New York City terminate in a fetal death and 80 percent in a live birth. Of the live births, between 2 and 3 percent die during the first year of life. In total, probably from 20 to 25 percent of pregnancies terminate either in a fetal death or in a live birth that fails to survive the first year of life.

This problem has been recognized by the World Health Organization, which has recommended that the term "stillbirth" be abandoned, and that all fetal deaths, irrespective of dura-

tion of pregnancy, be registered. Many years will be required before this recommendation can become generally effective since existing legal definitions of stillbirths must be changed and physicians must be convinced of the necessity of reporting every fetal death. It would be visionary to expect that the registration of fetal deaths, especially for pregnancies terminating after only 1 or 2 months, will ever be as complete as the reporting of infant deaths. Nevertheless, the experience in New York City is an illustration of what can be accomplished.

In the meantime, a new measure, the perinatal mortality rate, is beginning to be used. This is computed by dividing the sum of the number of infants dying during the first week or month of life and the number of fetal deaths during the last 4 or 5 months of pregnancy by the number of live births plus the number of fetal deaths included in the numerator.

In addition to the problem of developing a reliable measure of fetal mortality is that of obtaining information concerning the causes of fetal death. This is more complicated and difficult than obtaining information concerning the causes of infant deaths since death may be the result of conditions affecting the mother as well as the fetus. Moreover, medical information concerning the cause of death of fetuses has long been very inadequate. Plans are being made to develop better reporting of the causes of fetal death, but rapid progress should not be expected.

#### **Mortality Rates by Sex**

Existing data show that males experience a higher mortality rate from the early months of intra-uterine life until the end of the natural life span. Fragmentary data from genealogical records of ruling families indicate that males experienced higher mortality rates than females as long ago as the 15th century. In some countries and among some classes of the population, mortality rates have been higher for females than for males from about 15 to 30 years of age. This has been particularly true where mortality rates have been relatively high compared with those existing at present. As late as 1925 in the United States, the death rate for ages 15 to 34 years was practically as high for females as for

males. Since then the rate for males has exceeded that for females at every age.

The excess mortality among males has increased as the level of the death rates has fallen. In 1900, the age-adjusted death rate for white males was 10 percent higher than that for white females. By 1950 this difference had increased to 48 percent, and there is no indication that it may decrease in the near future.

The difference between the male and female mortality rates is now large enough to warrant an attempt to discover an explanation. To what extent is it the result of greater occupational hazards experienced by men? How much of the difference may be attributed to biological differences? The ratio of mortality rates for the two sexes is in striking contrast to the ratio of morbidity rates. Although morbidity data are rather inadequate, most studies report higher rates for females than for males.

#### **Mortality During Old Age**

Not only has the decline in mortality rates for every age among males in the United States failed to keep pace with the decline in mortality rates among females, but the decline in mortality rates for males more than 40 years of age in the United States also has not kept pace with the corresponding decline for males in most of the countries of northwest Europe, Canada, Australia, and New Zealand. To a lesser extent the same comment applies to the relative decline in death rates among females more than 50 years of age. During the first half of the life span, the mortality rates for males and females in the United States are among the lowest in the world. During the latter half of the life span, the rates for females are near the average of those for similar countries while the rates for males are among the highest of those for similar countries.

Several hypotheses have been advanced to explain this reversal of the relative rank of mortality in the United States during the first half in comparison with that during the second half of the life span but none of these have been adequately tested.

#### **Morbidity**

No comprehensive data concerning morbidity for the entire population of the United States

are available. The only extensive morbidity study ever conducted in this country was the National Health Survey of 1935-36, which was a survey of the urban population. Since that time a number of general morbidity surveys of individual communities have been carried out as well as a sample survey for one State but no national study has been undertaken. A few studies of morbidity from specific diseases also have been made.

In 1951 the United States National Committee on Vital and Health Statistics created a subcommittee to study the question of a national morbidity survey and to prepare a plan for such a survey keeping in mind the needs of local areas. The subcommittee recommended that a continuing national morbidity survey be conducted on a scale adequate to provide estimates for 50 regions of the Nation at intervals of 2 years and estimates for the Nation as a whole at 3-month intervals. The survey should be designed to collect information on the incidence and prevalence of diseases, impairments, and injuries, on the duration of any resulting disability, and on the amount and kind of medical care received.

This report (2) was published by the Public

Health Service in October 1953 and subsequently distributed to a number of interested individuals for comment. Although there has been rather widespread endorsement of the desirability of collecting national morbidity statistics, no funds have been available for initiating this work. There is much yet to be learned concerning variation in the frequency of fatal illness among different groups of the population. The frequency of nonfatal illness, however, greatly exceeds that of fatal illness. Our present knowledge of nonfatal illness in the United States is no further advanced than the knowledge of fatal illness at the beginning of the century.

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- (2) U. S. National Committee on Vital and Health Statistics, Subcommittee on National Morbidity Survey: Proposal for collection of data on illness and impairments: United States. Washington, D. C., U. S. Public Health Service Pub. No. 333, 1953. Processed.

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## Poliomyelitis Vaccine Injections

The desired levels of immunity in individuals given poliomyelitis vaccine are best derived from the dose schedule in current use, namely, two 1-cc. injections, the second dose 4 to 6 weeks after the initial dose or as soon thereafter as possible, with a booster dose 7 months or more after the second injection.

This was the unanimous opinion of leading virologists and immunologists representing the medical and health professions and the National Foundation for Infantile Paralysis at a meeting called by the Surgeon General on December 7, 1955, to consider how best to use the supply of poliomyelitis vaccine which will be available in the months ahead and to discuss available data on the methods of using the vaccine and spacing of doses. The discussion centered on the possibility of using one injection of 1 cc. in all susceptible individuals before giving the second and the booster injections.

Although it is evident that the injection of 1 cc. of vaccine produces a marked degree of immunity, there is not enough scientific evidence on the duration of immunity after a single dose to lead to any recommendation for a change in the present dosage, the group decided. The Surgeon General accepted the committee's recommendations.

*An environmental sanitation problem for the new atomic age may be created by the discharge of radioactive byproducts of nuclear reactions into surface streams. A first anticipatory step is to measure the effects, however slight, of such contamination.*

## Effects of Low-Level Radioactivity in the Columbia River

By CROSWELL HENDERSON, M.S., GORDON G. ROBECK, M.S.,  
and RALPH C. PALANGE, M.S.

THE Public Health Service conducted water quality studies on the Columbia River over a period extending from mid-1951 to mid-1953. Presented here is a brief summary of the general aspects of these studies, followed by a more extended account of the radiobiological phases.

### Initiation of Studies

In the accumulation of data to be used for pollution control programs throughout the Nation, it was found that information was needed on the Columbia River from at least two standpoints: (a) for determining the effects

of impoundments, several of which were proposed or under construction, and (b) for determining the effects of radioactive wastes on stream quality.

The construction of impoundments encourages the development of industrial sites, especially where additional power becomes available, and of recreational areas. In semi-arid regions, such as the Columbia River Basin, the increased availability of water for irrigation brings about the development of agricultural areas. Hence, the waters must serve a variety of interests, and in many cases the interests of one group are in conflict with those of another. In order that all interests may be served effectively, basic water quality inventories are necessary.

From the standpoint of the effects of radioactivity, the interests of health, defense, industry, and agriculture were recognized. As the use of radioactive isotopes continues to expand, the responsibility of public health officials for protecting the general population against harmful effects of ionizing radiation will broaden.

The Atomic Energy Commission and the General Electric Co., the present operating contractor at Richland, Wash., have a real interest in using the Columbia River as a source of industrial water supply and also for disposal of

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mildly radioactive cooling water from the nuclear reactors. They have, therefore, an understandable concern as to the possible effects of proposed multiple impoundments of the river for irrigation and power projects, lest changes in the characteristics of the stream have an unfavorable influence on plant operations. In addition, the joint interests of the States of Washington and Oregon as to the present and future uses of the river were an important consideration.

A continuous program for controlling the discharge of radioactive wastes to the Columbia River has been in effect since the start of plant operations in 1944. This program, carried out by the operating contractors at the Hanford Works, has included not only the control of waste discharges but also the monitoring of the river within and adjacent to the AEC reservation.

## Objectives

The principal objectives of the studies, therefore, were to determine (a) the water quality characteristics of the stream prior to impoundment and (b) the effects of radioactivity on the physical, chemical, and biological characteristics of the stream. The studies also provided data which can be used to establish objectives for comprehensive water pollution control programs. The field work was correlated with the continuous monitoring and research activities of the General Electric Co. at the Hanford Works.

## General Procedures

Most of the work was confined to the area between Priest Rapids and Paterson, Wash., a section which includes the Hanford Works and the McNary Reservoir. The latter is an impoundment which was placed in operation in late 1953. Limited studies were also made in Roosevelt Lake, Bonneville Reservoir, and the areas around Portland and Astoria, Oreg., to obtain information on existing impoundments and to determine the persistence of radioactivity to the mouth of the river.

In the Priest Rapids-Paterson section, shown in figure 1, three sampling ranges were

located well above the Hanford plant area to serve as control points. Other ranges in this section were located so as to detect the influence of the plant effluents and other variables, such as tributaries, downstream cities, and impoundments. At each range several types of biological samples were collected in the shallow regions, and water samples were collected at 3 to 10 points across the stream. A mileage index system was used to denote a sampling range or cross section; the designation C-362, for example, indicates a sampling point 362 miles above the mouth of the Columbia River.

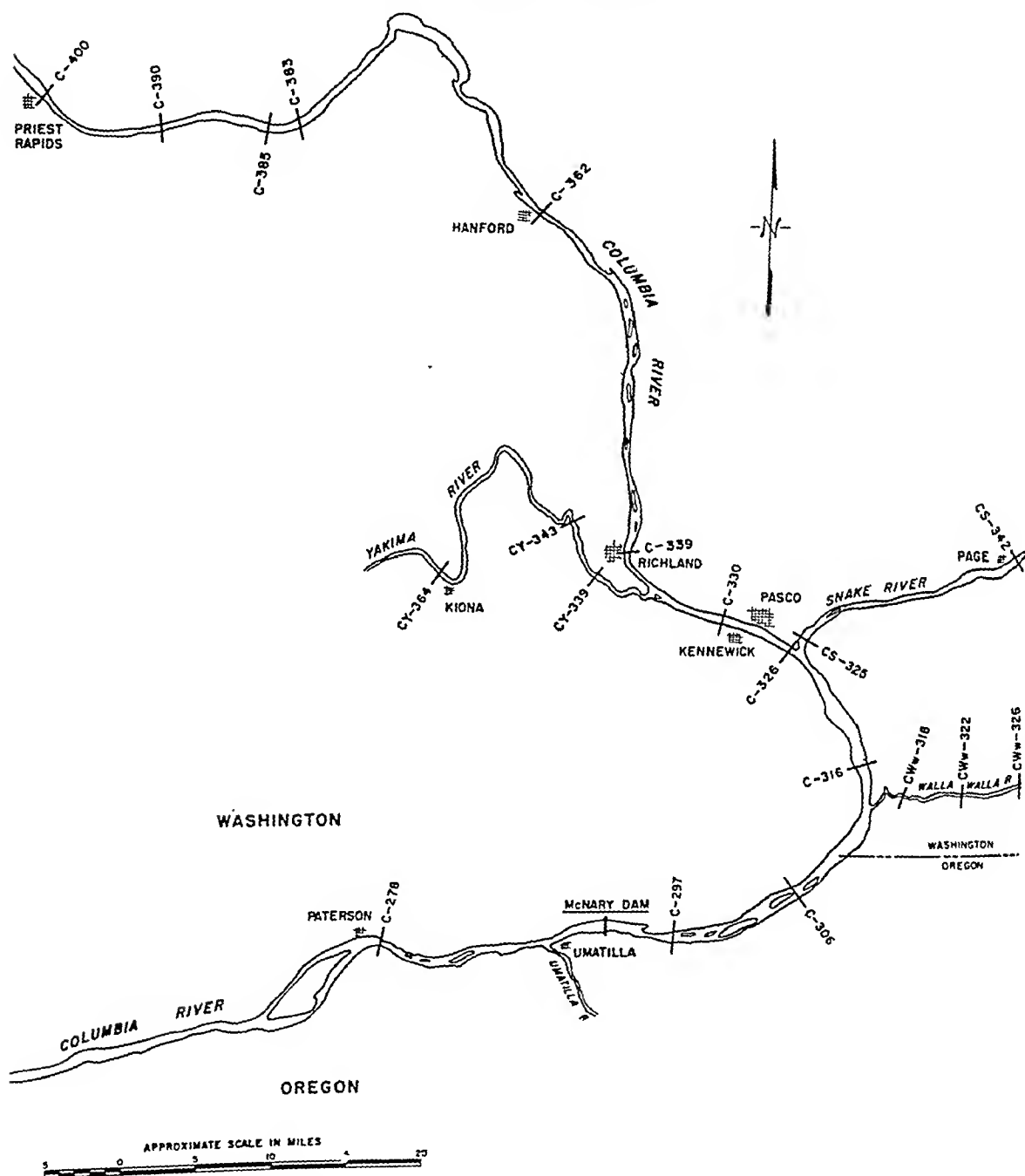
The routine physical and chemical examinations included determinations of turbidity, temperature, dissolved oxygen, ammonia, nitrites, nitrates, phosphates, sulfates, chlorides, pH, and total alkalinity. Mineral analyses were made for the elements considered necessary for plant and animal metabolism, as well as for components which might be toxic. Among these were calcium, magnesium, iron, manganese, zinc, and copper. Bacteriological studies were limited to the determination of coliform MPN.

In the biological studies, quantitative and qualitative samples of plankton, filamentous algae, bottom animals, and fish were collected. The sampling methods were those used in conventional stream surveys. Plankton was quantitatively determined by centrifuging and counting the organisms in a Sedgwick-Rafter counting cell. Bottom animal samples were collected in a square-foot riffle sampler and identified, and the numbers and weights of the various organisms were obtained. Fish were collected in seines and gill nets, and the relative abundance of the various species noted. Observations of spawning activity were made on some species of fish.

## Effects on Stream Characteristics

The Hanford plant effluents had no definite measurable effects on any of the physical or chemical characteristics of the Columbia River. Although some of the effluents were thermally hot, the magnitude of the flow in the river was such that there was no general temperature change. On several occasions, slight temperature increases were noted in the area near the

Figure 1. Sampling ranges in the Priest Rapids-Paterson section of the Columbia River, the principal area studied in 1951-53.



effluent outlets. Changes in river flows and the influx of major tributaries did have some effect on the physical and chemical characteristics. However, physical or chemical conditions that would be considered detrimental to aquatic life were not found at any time during the survey.

For many years, the hydrological, physical, and chemical characteristics of the river have followed a definite seasonal pattern. High flows of 300,000 to 400,000 cubic feet per second generally occur between May and July. The most turbid water reaches the Hanford area in

late April or May. During the rest of the year the flow is generally about 50,000 to 60,000 cubic feet per second, and the turbidity is less than 7 p.p.m.

Coliform counts in the Columbia River varied from less than 3.6 to 4,600 MPN per 100 ml. of water. Population centers and tributaries were principally responsible for these variations.

The Hanford plant effluents had little or no effect on numbers and species of river organisms. The variety and abundance of most river organisms were similar above and below the manufacturing areas. Where any differences occurred, they could be attributed to the seasonal variation or the influence of the relatively more turbid, warmer tributaries.

### Radiobiological Studies

Although many radioactive wastes and coolants are produced in the manufacture of plutonium at the Hanford plant, the only large effluent to enter the Columbia River directly results from the cooling of the nuclear reactors. The radioactivity is induced by the neutron bombardment of dissolved and suspended materials in the cooling water. The passage of these materials through the atomic pile is held to a minimum by conventional pretreatment of the coolant. The radioisotopes produced in the coolant are principally beta-particle emitters with short half-lives; consequently, retention of the coolant in large open tanks, which provides time for some natural decay, substantially reduces the amount of radioactive material that enters the river.

Water and biological samples, collected weekly or biweekly, were prepared for radiobiological measurement by reducing the sample to a minimum size for insertion into a Geiger-Müller tube, end-window counter. For most solid samples, reduction was accomplished by digesting the organisms in nitric acid and ashing the digestate in a muffle furnace. The residue was then plated on a 1-inch stainless steel planchet and counted for 5 to 15 minutes. The raw count was corrected for decay, geometry, scatter, and absorption, and the results were reported in terms of microcuries per gram of original tissue.

### *Average Levels of Radioactivity*

The average gross beta activity density of the water and of the various river organisms (plankton, filamentous algae, caddisfly larvae, and fish) at two of the ranges is given in figure 2. Range C-362, which showed the highest average results, is located just below all nuclear reactors, and range C-278, which showed the lowest average results in the principal study area, is the last range downstream in this section. It is evident from these data that the river organisms concentrate radioactive materials to a considerable degree, up to nearly 10,000 times the total beta activity in the river water. River flows and temperatures at the two ranges are also given in figure 2, for correlation with the radioactivity density.

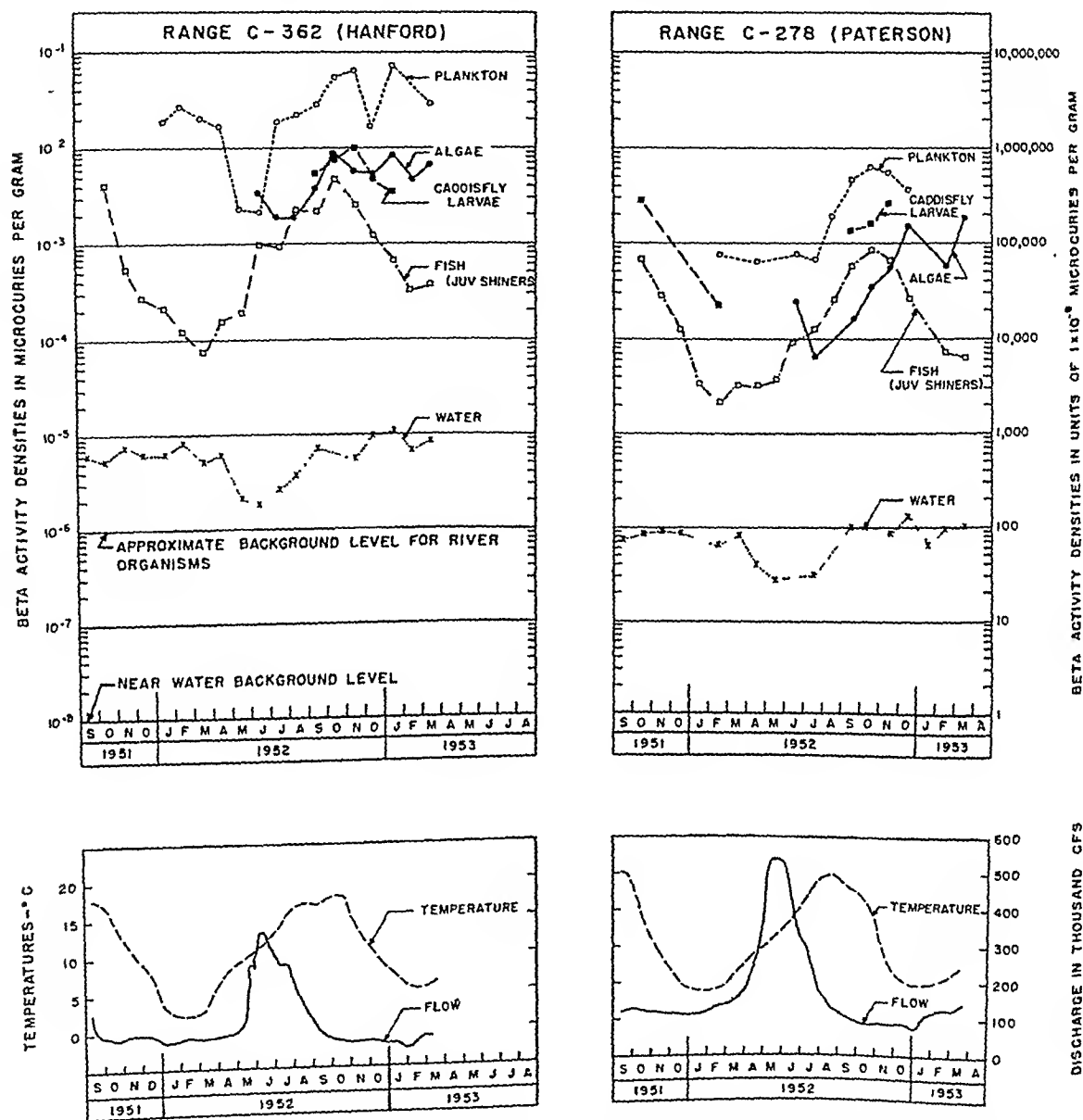
The accumulation of radioisotopes by aquatic organisms followed a definite pattern. Plankton (mostly phytoplankton) and filamentous algae, which absorb nutrients directly from the water, showed the greatest concentration of radioactive materials. The next greatest concentrations were found in bottom animals, which feed on these organisms; the next, in juvenile fish, which feed principally on the bottom animals. At the end of the chain were the adult game fish, which feed on the juveniles. There were, of course, some deviations from this pattern. Fish that feed directly on plankton and algae reflected higher values in individual samples, whereas crayfish, which possibly feed on dead fish or other animals, reflected lower values.

Levels of radioactivity in plankton and algae were directly dependent upon the radioactivity levels in the water, which were in turn dependent upon river flows and the amount of radioisotopes released into the stream. Values were highest at low water stages, but they were not influenced greatly by changes in water temperature.

Radioactivity levels in most aquatic animals varied with the volume and radioactivity density of the food they consumed. The volume of food consumed depended on their metabolic rate, which in turn depended upon water temperatures. Values for bottom animals were highest at low water stages and high water temperatures. There was a decrease in radioactivity in the organisms with a decrease in water



Figure 2. Seasonal variations in beta activity densities in the water and in various organisms of the Columbia River.

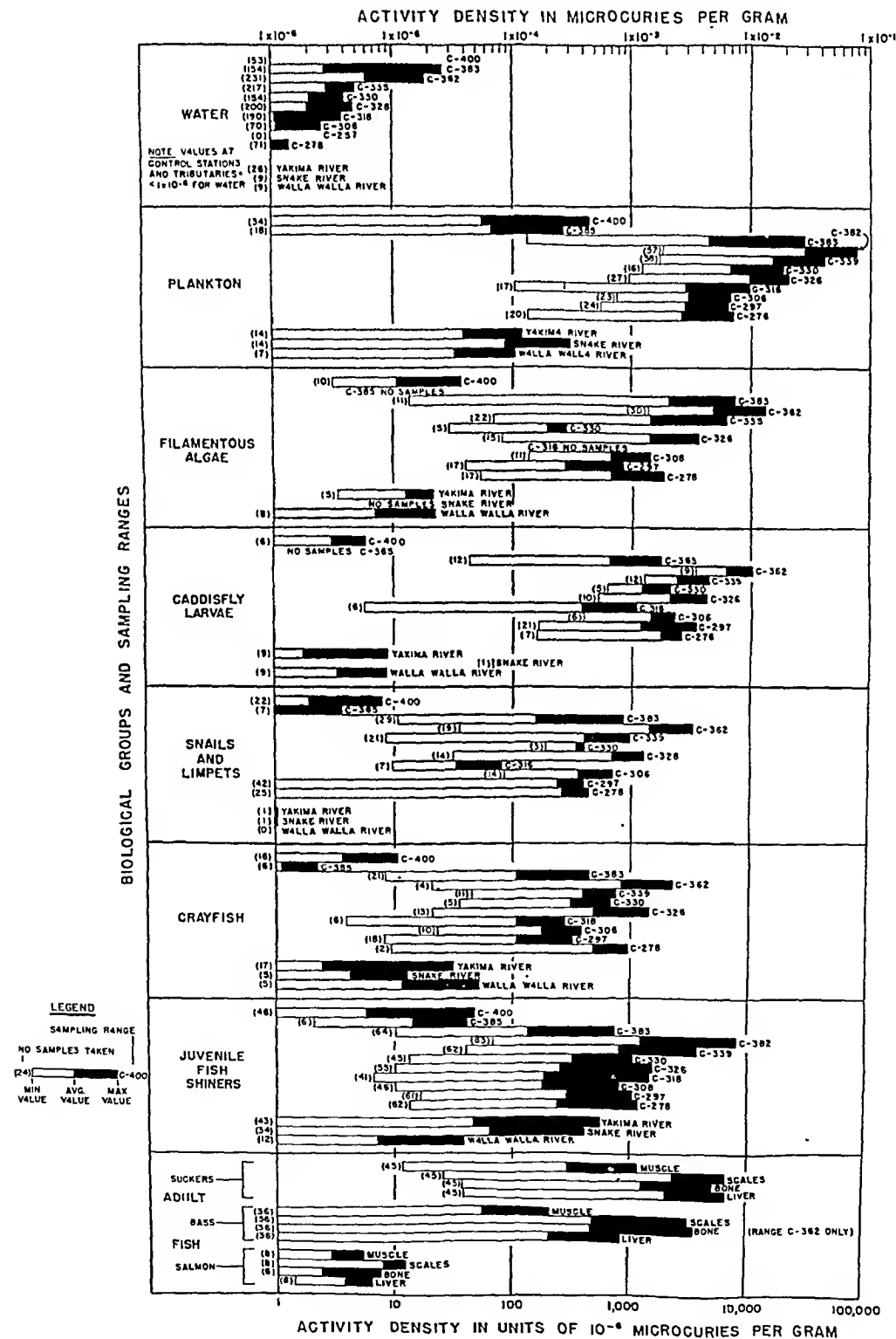


temperature, even though the radioactivity of the materials upon which these animals feed remained relatively high.

The decrease in radioactivity levels with a decrease in water temperature was most marked in fish. Some species, such as bass, which are known to stop feeding when water temperatures are low, showed very low radioactivity levels during the winter months in spite of the fact that there was little or no reduction in the radio-

activity level of the water. The radioactivity levels in these fish rose rapidly with the resumption of conditions conducive to feeding even though radioactivity levels in the water were lower than previously observed because of increased river flows. In other species, such as suckers and whitefish, which evidently feed to some extent even during periods when the water is cold, the reduction in radioactivity was less pronounced. The radioactivity in adult sal-

Figure 3. Gross beta activity densities in water and in various organisms of the Columbia River.



mon, which migrate to this section of the Columbia River from June to October for spawning but do not feed, remained at very low levels.

Resident species which are feeding during this same period contained relatively large amounts of radioactive materials. Apparently, most aquatic animals concentrate radioisotopes of the type encountered in the Columbia River from the food they eat rather than by absorption through the skin or gills.

### Types of Radioisotopes

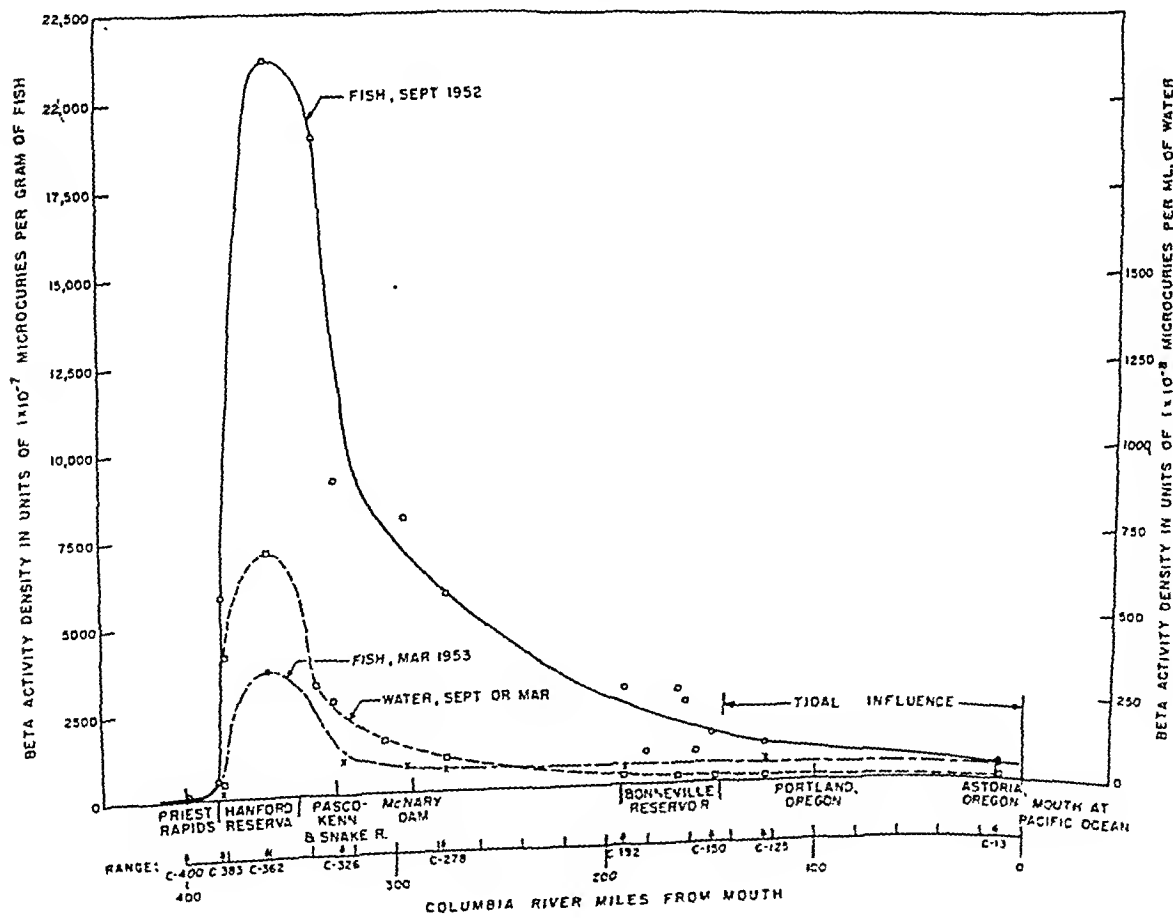
The principal radioisotopes in the river water at range C-362 were such short half-life ones as copper-64 (12.8 hours), manganese-56 (2.6 hours), sodium-24 (15.1 hours), arsenic-76 (26.8 hours), and silicon-31 (2.8 hours). At this range, only about 1 to 2 percent of the

activity was from the longer half-life phosphorus-32 (14.3 days), but at ranges farther downstream this radioisotope became more predominant percentagewise, since the activity from the short half-life radioisotopes had been reduced at a greater rate by natural decay.

The radioisotopes were selectively absorbed or concentrated differently by the various river organisms. Hatchery experiments with trout and salmon (1) have indicated that phosphorus-32 is concentrated in fish principally from food, whereas sodium-24 is absorbed directly from the water. Other radioisotopes may or may not be utilized by the various organisms, but small amounts may be taken into the body in food material.

At range C-362, most of the radioactivity in plankton was due to the short half-life radio-

Figure 4. Variation in average beta activity density in water and fish with location in the Columbia River.



isotopes mentioned previously. The proportion from the somewhat longer half-life phosphorus-32 was relatively small. Some of these short half-life radioisotopes may have been adsorbed on the siliceous diatom shells, which make up a large part of the river plankton. Farther downstream, a larger portion of the activity is caused by phosphorus-32.

The radioactivity in fish and other river animals was primarily from phosphorus-32, even near the areas where nuclear reactors are located. Since the percentage of phosphorus-32 in the water was low, it is evident that this radioisotope was concentrated many thousand times in some river animals. Only a very small part of the radioactivity in any of the river organisms was from radioisotopes with longer half-lives than phosphorus-32.

#### *Variations in Radioactivity Levels*

Owing principally to the decay of the relatively short half-life radioisotopes, the gross beta activity density decreased downstream. The activity levels in the river water and in the various river organisms at the different sampling ranges are shown in figure 3. The values decreased rapidly from Hanford (C-362) to Richland (C-339) and somewhat more gradually thereafter, a pattern followed with only slight variations in both the water and the river organisms.

The activity density of adult fish at one sampling range, C-362, is also given in figure 3. The values shown are the highest values for individual parts or organs of each species of fish. The activity density of scales, bones, and internal organs was about 10 times the activity density of the flesh and skin, the edible parts.

The pattern of activity densities in water and fish from Priest Rapids, Wash., to the mouth of the river near Astoria, Oreg., is shown in figure 4. Although some radioactivity is detectable all the way to Astoria, the values are very small in comparison with those found in the Priest Rapids-Paterson section.

The higher radioactivity values found during this survey were from within the Hanford Reservation, but values of similar magnitude have been reported from other areas during a limited period. Values as high as  $2.2 \times 10^{-3}$   $\mu\text{c./gm.}$  have

been found in the muscle of whitefish near Priest Rapids (2).

Other river organisms had gross beta activity densities considerably higher than adult fish, but these organisms are not utilized to any extent by humans. Thus, their major significance is in transmitting this activity to other organisms in the food chain. Fish, as well as ducks, geese, and other animals, may consume these organisms.

As previously pointed out, there were no observable, immediate biological effects on any of the river organisms from radioactivity levels in the Columbia River found during these studies. The genetic changes that may occur in aquatic organisms over a long period were beyond the scope of these studies. Some work on the question of genetic changes is being carried out by the General Electric Co. (3).

Although certain of the radioactivity levels found in the Columbia River organisms appear high when compared to maximum permissible concentrations in the human body, the maximum permissible concentrations for fish and other aquatic organisms have not been definitely established. Some of the work at the University of Washington (4-6) has indicated that the amounts of X-radiation of consequence to certain plankton forms and fish are much larger than quantities permissible for man. The effects of such concentrations in fish eaten by man have not been ascertained.

#### **Public Health Aspects**

Because fish and other aquatic organisms concentrate radioactive materials many times above the levels found in water, the use of these organisms for human or animal consumption presents a potential public health problem. Fortunately, most of the radioactivity in fish is from phosphorus-32, a relatively short half-life radioisotope. Natural decay helps in reducing the activity before the fish is eaten. Also, a large portion of the activity is in parts of the fish not used for food, such as scales, bones, and internal organs.

Based on a maximum permissible concentration of  $200 \times 10^{-6}$   $\mu\text{c./ml.}$  and an average daily intake of water of 2,200 ml. (7), the maximum permissible intake of phosphorus-32 for man is

0.44  $\mu\text{c.}$  a day. The average level of radioactivity for the highest 13-week period in the muscle of Columbia River game fish, such as bass, was  $100 \times 10^{-6} \mu\text{c./gm.}$ , and in Columbia River suckers it was  $500 \times 10^{-6} \mu\text{c./gm.}$  Salmon and other migratory species do not appear to be important from the standpoint of ingestion of radioactive materials by man since very little of these materials are concentrated in the adults of the species.

Although the amount of fish flesh that man might eat daily before reaching the maximum permissible ingestion of radioactive materials can be computed on the basis of the results of these studies, such a figure would not be too realistic. Few, if any, humans would eat the indicated quantity of fish daily over a lifetime. Moreover, the fish are not eaten immediately after being caught, some time being required for cleaning, cooking, and other preparation. Thus, the actual permissible intake would be greater than the figure computed.

### Conclusions

The following major conclusions regarding radioactivity in the Columbia River are drawn from the Public Health Service studies of 1951-53:

1. Low-level beta activity has had no adverse effect upon the numbers and species of aquatic organisms in the Columbia River.

2. The radioactivity levels in plankton and attached algae are directly dependent upon levels in the river water.

3. The radioactivity levels in aquatic animals vary with their metabolic rates (which in turn vary with water temperatures) and with the radioactivity levels of the materials upon which they feed.

4. Migratory species in the Columbia River such as salmon, the adults of which do not feed in fresh waters, have low radioactivity levels at the same time that levels in resident species are high.

5. Radioactive materials are concentrated in all parts of the body of the fish. The activity

levels, however, are about 10 times higher in scales, bones, and internal organs than in the edible parts, such as muscle and skin.

6. Since aquatic organisms concentrate specific radioisotopes such as phosphorus-32 many thousand times above the levels in water, the use of these organisms for human or animal consumption presents a potential public health problem. However, to date the levels of radioactivity in the flesh of Columbia River fish are not dangerously high.

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*New York State used the home interview technique to gather data for determining accident rates for a sample of motor vehicle drivers in Saratoga Springs. From this preliminary study, we learn that it is possible—if the data are sufficient and the population is well defined—to obtain reliable rates on which to base future accident prevention activities.*

## An Epidemiological Approach to Traffic Accidents

By WILLIAM G. BEADENKOPF, M.D., M.P.H., ADELE K. POLAN, M.A., WALTER E. BOEK, Ph.D., ROBERT F. KORNS, M.D., Dr.P.H., and GEORGE JAMES, M.D., M.P.H.

MOST traffic accidents are apparently due to errors in the decisions of drivers rather than to defects in the motor vehicle or hazards present on the road. It has been estimated from analyses of accident reports that 75 to 90 percent of all traffic accidents can be attributed to human error (1). Although acci-

dent report data are admittedly not entirely reliable, particularly with regard to the designation of human error as the responsible factor, it remains likely that some large portion of automobile accidents result from miscalculation by the driver.

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There is considerable evidence which suggests that several characteristics of the driver are associated with a high risk of involvement in the accident. Persons with high levels of alcohol in the blood have been found to be involved in accidents more frequently than those without such levels of alcohol (2, 3). Individuals who become involved in accidents repeatedly have been characterized as accident prone although the permanence of this characterization is uncertain (4). A variety of driver selection studies by commercial and military agencies have tested intelligence, speed and accuracy of perception, learning of coordination, and certain attitudes (1). When accident reports from general populations are analyzed according to age, it has been found that young persons between 18 and 25 have a disproportionately high number of accidents (5).

### To Identify the Hazardous Driver

The many procedures that have been employed have met with varying success in the

attempt to identify individuals with a greater likelihood of becoming involved in accidents. The aim common to all such efforts is to identify the hazardous driver in order to exclude him from the driver population, at least until he has been successfully retrained. With few exceptions, however, the evidence supporting these means for detecting hazardous drivers has apparently not been sufficiently convincing to warrant general acceptance as screening procedures by official agencies charged with licensing drivers. This lack of acceptance may be due in part to the nature of the attributes chosen for study or to the particular methodology of the study. Whatever the reason, the result has been that the findings cannot easily be applied to the general population.

The New York State Department of Health thought it worth while to attempt to apply the epidemiological approach to a study of traffic accidents. Consultations with traffic authorities lent encouragement to the plan and also provided essential technical advice. Close sociologic supervision was supplied throughout

all stages of the planning and operation of the study. Special attention was given to interviewing techniques and sampling of the population.

The epidemiological method consists essentially, first, of grouping the members of a general population according to well-defined characteristics, such as age, sex, occupation, and, where possible, exposure to the event or disease under study; and, second, of determining the proportion of the groups that experiences the event or becomes ill. This information is useful in order to determine how a disease starts or where it exists in a community, how it spreads, and where control measures should be applied.

The epidemiological approach has proved of value in the control of many diseases—occupational diseases are an example. An epidemiological study, therefore, of certain attributes of the driving population of a community holds promise for ascertaining whether the traffic accident problem is in reality largely one of human behavior.

Figure 1. Proportion of adult population who are drivers, according to age and sex.

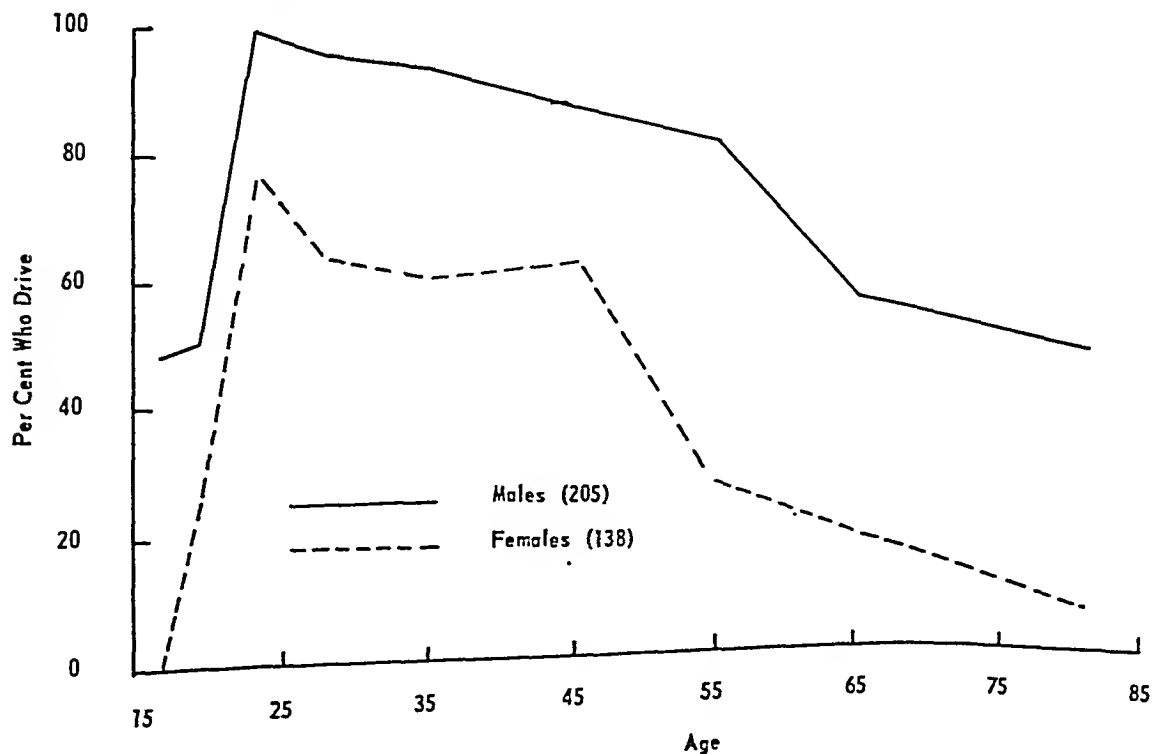
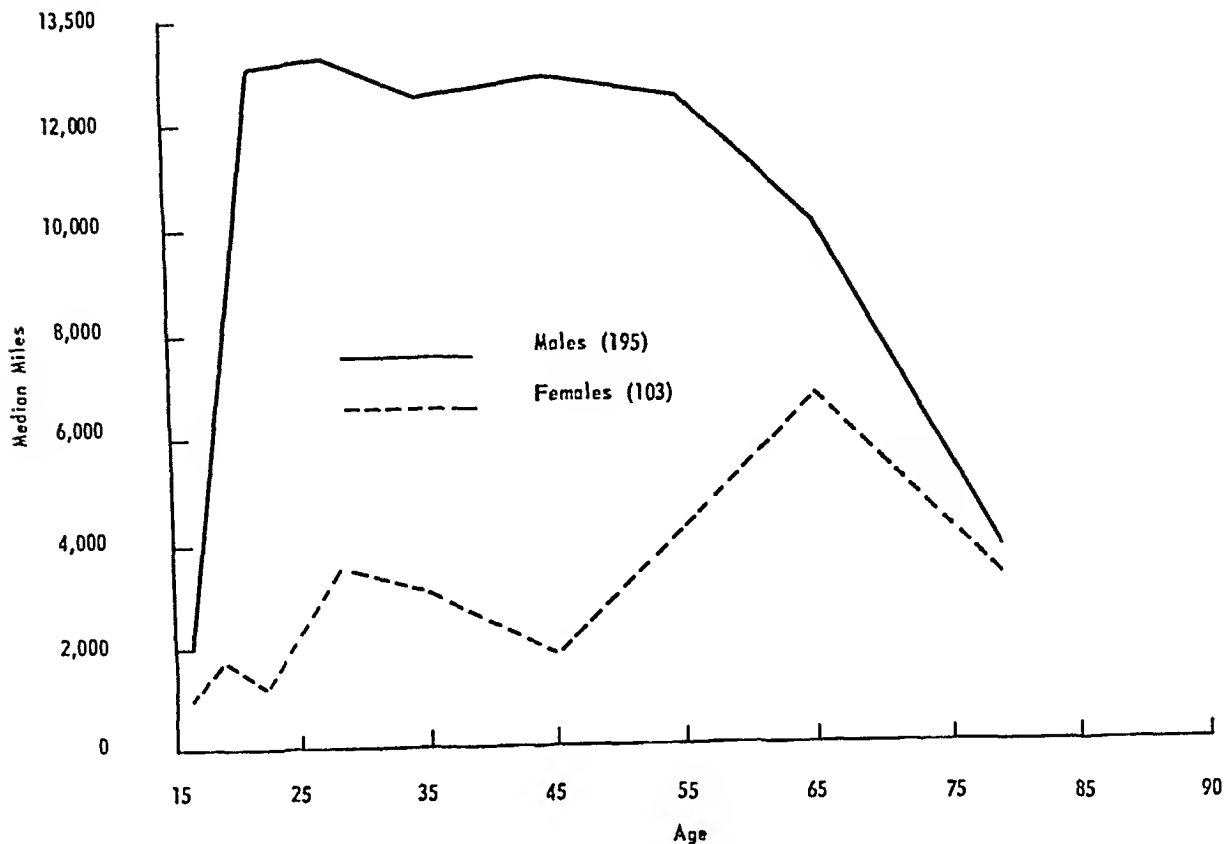


Figure 2. Exposure to traffic accidents in terms of the median miles driven during preceding year, according to age and sex.



This report presents some of the data obtained in the health department's exploratory study in traffic accident epidemiology. In the hope of stimulating critical interest, illustrations of some of the techniques that were employed are presented in the form of graphs or tabulations.

### The Sampling Techniques

Our investigation was made during a 3-week period of clear weather in late November and early December 1953 at Saratoga Springs, N. Y. The population studied consisted of a sample carefully selected in the hope that it would be representative of the city and the surrounding natural trading area, a zone of approximately 5 miles. The sampling procedure was one of assigning consecutive numbers to all blocks on a map of the city and to all segments of the rural area, and, then, by reference to a table of random numbers, of choosing

a sample of blocks and segments to be studied. Every fourth household of each sample block or segment was assigned for interviewing.

An attempt was made to interview all individuals 15 years and older in the study population. Children under 15 were enumerated only. Interviews were successfully obtained with 563 of the 637 individuals in the study group but not with 74 persons, most of whom were not at home on repeated visits. Seventeen declined to be questioned. The 74 individuals who fell in our theoretical sample, but who were never interviewed, do not form a part of the study population.

The interviewing was handled by 9 biostatisticians, 2 physicians, and 1 cultural anthropologist, all from the health department. Twenty-nine sociology students at Skidmore College assisted. To assure consistency in the use of interview techniques, each interviewer was given several hours of training. Interview questions had been pretested in the city of



**Table 1. Sources of data and severity of accidents occurring to drivers in the study population**

Source of data	Number of drivers	Severity			
		Fatal	Personal injury	Property damage	Severity not known
Total.....	25	1	1	13	10
Interview and motor vehicle bureau file.....	10	1	1	8	9
Interview alone.....	9				
Motor vehicle bureau file alone.....	6			5	1

Oneonta with the assistance of sociology students in the Oneonta State Teachers College.

Information was sought on a variety of subjects that can be described briefly as identifying information, exposure to traffic accidents, driving experience in number of years of driving, description of automobile trips on the day before the interview, health status, income, occupation, involvement in a traffic accident occurring earlier in 1953, and some opinions on the driving regulations and traffic problems of Saratoga Springs.

## Some of the Findings

Examination was made of the study population by age and sex, according to whether or not the respondent drove a motor vehicle. In all age groups a considerably larger proportion of men than women are drivers, it was found. This finding is illustrated in figure 1, which also shows a steady decline in the proportion of drivers with increase in age. Of the persons interviewed, 264 were men and 299 were women. Seventy-eight percent (205) of the men and 42.5 percent (138) of the women were drivers.

Exposure to traffic accidents was determined in terms of the number of miles that the individual stated he had driven during the preceding months in 1953. The variations in exposure by age and sex are shown in figure 2.

The median number of miles driven per year varies from 1,200 miles (women, 21-24) to more than 13,000 miles (men, 21-29). It can be seen from the figure that the line for women is consistently below that for men, although several points on the curve are based on only a few observations.

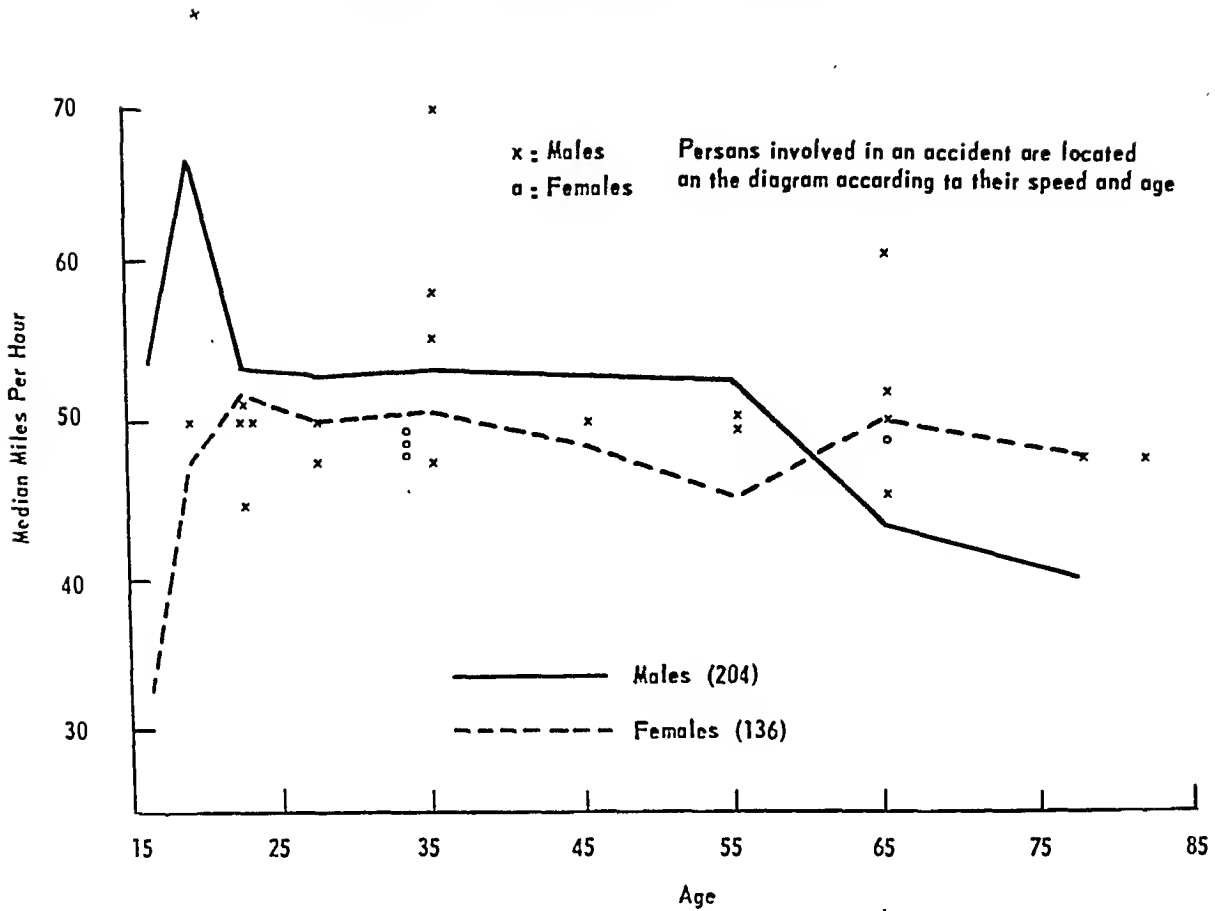
Twenty-five members of the study population had been involved in automobile accidents during the 11-month period between January 1 and

**Table 2. Accident rates for the study population according to age, sex, and exposure in terms of median miles driven during 11 months, 1953**

Age group	Men					Women				
	Median miles per year	Number of drivers	Total miles	Number of drivers in accident	Accident rate	Median miles per year	Number of drivers	Total miles	Number of drivers in accident	Accident rate
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Total.....	11,400	208	2,375,000	21	8.8	2,800	138	380,000	4	10.5
15-17.....	2,000	8	16,000	2	66.7	1,000	1	1,000		
18-20.....	7,500	4	30,000			1,700	7	12,000		
21-24.....	13,100	17	223,000	4	17.9	1,200	11	13,000		
25-29.....	13,300	24	320,000	2	6.3	3,500	25	88,000		
30-39.....	12,500	48	600,000	4	6.7	3,100	43	132,000	3	22.7
40-49.....	12,900	40	514,000	1	1.9	1,900	28	53,000		
50-59.....	12,500	29	363,000	2	5.5	4,300	13	55,000		
60-69.....	10,000	21	210,000	4	19.0	6,700	8	53,000	1	18.7
70-89.....	3,500	14	54,000	1	18.4	3,500	2	7,000		
Not stated.....		3		1						

NOTE: Number of miles has been rounded off to nearest hundred. Accident rates were calculated from original figures.

Figure 3. Stated usual speed on open road.



(approximately) December 1, 1953. Data on the number of accident-involved persons and the severity of the accidents are presented in table 1. No distinction was made by our investigators between persons to blame or not to blame for their accidents, nor was the definition of a traffic accident elaborated on in any great detail.

The information about accidents was gathered from two sources: the interview and the New York State Bureau of Motor Vehicles.

In the interview the question was asked, "Have you by any chance been involved in an accident since January 1 of this year? I would like to know about all accidents regardless of whether or not it was your fault or how small it was." The respondent himself was depended on to determine what constituted a motor vehicle accident.

Search of the accident file of the bureau of motor vehicles over the 12-month period Janu-

ary 1 to December 31, 1953, corroborated 10 of the accidents reported by the respondents. However, six reports were found in the bureau file for accidents that were not reported during the interviews. Nine persons stated that they had been in accidents, but reports for these accidents were not found in the bureau file.

A portion of these individuals may have had accidents which occurred outside New York State or accidents which involved no other car. Some also were too minor to report on legal grounds since New York State law requires that reports be filed only for an accident that involves personal injury or property damage over \$50. Details were not obtained about the accident during the interview, and, therefore, it is not possible to estimate the severity of the latter group of accidents. We did not expect to obtain as many accidents as we did from the interviews. We anticipated that the severity could be better measured by the official reports.

Accident rates are presented (table 2) according to age, sex, and exposure. In order to derive the rate, the median number of miles driven during the year of exposure (column *a*) was multiplied by the number of drivers in each age group (column *b*). The product (column *c*) represents the total exposure for an age group. The number of accident-involved persons (column *d*) is divided by the total exposure

(column *c*) to obtain the accident rate per million miles of exposure (column *e*).

The limited size of the study material, as reflected in the small number of accidents, makes for unstable rates. This instability is especially apparent in the rates shown for women drivers. However, there is a suggestion in the data that men aged 25 to 59 experience lower accident rates than men of other ages.

Table 3. Accident rates for various driver characteristics, according to sex and exposure

Response	Men				Women			
	Number of drivers	Median miles per year	Number of drivers in accident	Accident rate	Number of drivers	Median miles per year	Number of drivers in accident	Accident rate
<b>Alcohol consumption:</b>								
Never drink.....	48	8,800	5	11.9	33	1,600		
Drink.....	159	12,300	16	8.2	104	3,200	4	12.2
Not stated.....	1				1			
<b>Body height-weight evaluation:</b>								
Underweight.....	12	12,500	1	6.7	20	3,000	1	16.7
Normal weight.....	140	10,900	15	9.8	92	2,800	2	7.8
Overweight.....	55	12,700	5	7.1	24	1,900		
Not stated.....	0				2		1	
<b>Wearing glasses while driving:</b>								
Wears glasses.....	67	11,800	7	8.9	49	2,300	2	17.7
Does not wear glasses.....	138	11,500	14	8.8	88	3,000	2	7.5
Not stated.....	3				1			
<b>Opinion on posted speed limits:</b>								
Too low.....	29	15,600	2	4.4	7	1,700	1	83.3
Satisfactory.....	160	11,800	19	10.1	127	2,800	3	8.4
Too high.....	16	4,300			1	1,000		
Not stated.....	3				3			
<b>Stated usual speed on road:</b>								
30-40 m.p.h.....	17	2,500			17	1,100		
40-50 m.p.h.....	51	10,200	4	7.7	51	3,300		
50-60 m.p.h.....	116	13,500	14	8.9	58	3,000	4	17.6
60-85 m.p.h.....	19	13,100	3	12.0	6	5,000		
Doesn't drive on open road.....	4	1,000			2	1,000		
Not stated.....	1				4			
<b>Family income:</b>								
Under \$3,000.....	46	10,000	4	8.7	28	5,000	1	7.1
\$3,000 to \$5,000.....	92	10,600	12	12.3	61	2,000	1	8.4
\$5,000 to \$9,000.....	47	12,700	4	6.7	30	3,700		
\$9,000 to \$12,000.....	14	13,300			6	1,700	1	100.0
\$12,000 and over.....	3	12,500	1	26.3	3	3,500		
Not stated.....	6	25,000			10	2,000	1	50.0
<b>Where driving is done:</b>								
City.....	99	10,900	12	11.1	75	2,500	1	21.3
Country.....	22	10,500	1	4.3	13	2,000		
Highway.....	8	17,500			4	3,000		
Mixed.....	71	12,200	8	9.3	41	4,400		
Own property.....	3	1,000			1	1,000		
Not stated.....	5	7,500			4	1,500		

NOTE: Number of miles has been rounded off to nearest hundred. Accident rates were calculated from original figures.

**Table 4. Miles driven according to the day of the week**

Day of driving	Drivers interviewed	Drove day before interview		Mean miles per person driving
		Number	Percent	
Total.....	346	235	67.9	33.9
Sunday.....	66	48	72.7	41.6
Monday.....	58	37	63.8	17.6
Tuesday.....	58	44	75.9	42.5
Wednesday.....	58	40	69.0	26.3
Thursday.....	32	19	59.4	46.2
Friday.....	58	37	63.8	23.4
Saturday.....	16	10	62.5	32.9

The sharp difference in the number of miles driven by men and women is also brought out in table 2. By comparing column *a* with column *f*, we see that a man drives approximately four times as much as a woman. Coupled with this difference is the additional fact that there are more men drivers than women drivers, as shown in figure 1. Thus, for every mile driven by a woman (column *h*), there are 6 miles driven by a man (column *c*).

### Some Additional Characteristics

The home interviews produced a variety of additional data. Much of this information would prove useful for further identification of hazardous drivers if the quantity of study material permitted. Several characteristics of drivers are presented (fig. 3 and table 3), to illustrate how a particular age and sex group with a high accident rate could be further analyzed according to such factors as drinking, habitual rural or urban driving, opinion on speed limits, usual speed of driving.

One of these characteristics, the usual speed driven, is diagramed in figure 3. Speeds that respondents said they usually drove on the open highway are plotted against age for both sexes. The line, in the figure, for women lies under the line for men in all age groups below age 65. By designating the 25 accident-involved individuals as *x* and *o* (*x* for men, *o* for women) on the diagram, we can see that accidents are distributed about equally above and below the median speeds. This distribution suggests that

high-speed drivers and low-speed drivers experience a similar number of accidents. However, it should be pointed out that correcting the data for driving exposure and for the factor of the reliability of the statements on speed would provide a more accurate interpretation.

Examples of additional characteristics are shown in table 3. These topics presented no insurmountable problems in most of the interviews. Responses were usually given freely, with an effort to be accurate, to such delicate questions as drinking, income, previous driver license suspension—not shown in the table, but license suspension was admitted by 10 persons. The determination of income by interview of a sample in a population has been employed successfully, of course, in numerous sociologic surveys. Several questions were asked about the presence of a chronic disease or a disability—not included in the table either—but the small base population did not yield many individuals so afflicted.

Some examples of the activities which the drivers reported for the day before their interview are examined in tables 4–6. The question as to what trips were made yesterday (table 4), a query frequently used in origin-destination surveys, has been successfully applied to the analysis of traffic flow for the design of traffic arteries (6). A group of individuals identified as those who drank before driving was compared with a group who did not drive after drinking (table 5). The time of drinking was compared with the time of driving on that day, about which inquiry had been made earlier in the interview. From the inquiry about medications taken on the day before inter-

**Table 5. Alcohol consumption on day before interview**

Response	Number of drivers	Percent
Total.....	346	100.0
Did not drink.....	271	78.3
Drank.....	73	21.1
Drove after drinking.....	27	7.8
Did not drive after drinking.....	46	13.3
Not stated.....	2	.6

**Table 6. Medications taken on day before interview**

Medication	Number of drivers	Persons who drove yesterday		Persons who did not drive yesterday	
		Number	Percent	Number	Percent
Total.....	346	235	100.0	111	100.0
Antihistamine.....	5	3	1.3	2	1.8
Aspirin.....	13	8	3.4	5	4.5
Injected material.....	1	1	.4	0	0
Insulin.....	0				
Prescription.....	10	7	3.0	3	2.7
Sedative.....	0				
Tonic.....	4	2	.9	2	1.8
Vitamin.....	14	10	4.3	4	3.6
Other.....	4	4	1.7	0	0
Not stated.....	11	8	3.4	3	2.7
No medication.....	284	192	81.7	92	82.9

view (table 6), it is of interest that no substantial decrease in driving was observed for the 35 persons who took some type of medicine.

Many additional analyses were attempted of variables of interest in highway safety. Some of these analyses included these characteristics: speed by family income groups, number of trips made and number of passengers carried on day before interview, frequency of driving, time of driving, and stated usual speed on open road according to occupation. More extensive investigation is required to yield reliable information on these factors.

### Validation of the Findings

Some characteristics of the study population were compared with those described for the Saratoga Springs area by the 1950 national census in order to see whether the sample studied was truly representative of the community. Close similarity between the sample and the actual population was found in the proportion of men and women, of nonwhites, and of individuals in gross age groupings, household size, occupation, and family income. In the inquiry about occupation, sufficient details were not obtained to permit classification of a professional driver group since the emphasis was placed upon a classification that could be compared with census data.

In an effort to measure validity, the results of the inquiry about age and driver status have been compared with data from another source. A comparison is shown in table 7 of the ages of drivers interviewed in the study and the ages of drivers licensed in upstate New York. The close similarity in the age structure of the two populations serves as evidence for reliability of the sampling and interviewing procedures employed in this study.

The accident rates computed for the data shown in table 3 are intended to illustrate method and cannot be considered stable. The stability of the computed rates was examined by determining the variation that exists in a random subgrouping of the sample. Rates were computed for subgroups according to their household numbers. Variation in rates among the subgroups was found to equal or exceed many of those in the data presented.

Validation of responses on each of the interview topics (table 3) is highly desirable before any inferences are to be drawn and should be done wherever possible in larger samples that may be studied. The validity of responses

**Table 7. Composition of driving population in regard to age and sex and in comparison with a 1952 sample of licenses in the New York State Bureau of Motor Vehicles<sup>1</sup>**

Age group	Driving population in study						Percentage of drivers licensed by bureau
	Men		Women		Both sexes		
	Number	Percent	Number	Percent	Number	Percent	
Total	205	100.0	138	100.0	343	100.0	100.0
15-17	8	3.9	1	0.7	9	2.6	1.2
18-20	4	2.0	7	5.1	11	3.2	4.3
21-24	17	8.3	11	8.0	28	8.2	7.7
25-29	21	11.7	25	18.1	46	14.3	12.4
30-39	48	23.4	43	31.2	91	26.6	25.5
40-49	40	19.5	28	20.3	68	19.8	20.9
50-59	29	14.1	13	9.4	42	12.2	15.6
60-64	12	5.9	4	2.9	16	4.7	5.5
65 and over	23	11.2	6	4.3	29	8.4	6.9

<sup>1</sup> The sample was taken from licenses of drivers registered with the bureau of motor vehicles in upstate New York.

<sup>2</sup> The age groups 15-24 years include 8 drivers without any license.

should be tested especially for the desire of the respondent to be accurate and his ability to supply accurate estimates of rather complex activities. The estimate of the number of miles driven during the preceding months in 1953 (fig. 2), for example, was difficult to determine for some individuals, particularly for some professional drivers and some housewives. Reliability and accuracy of the responses regarding exposure require further study.

The validity of the estimates of exposure that have been employed in the calculation of accident rates is of special interest. In the inquiry about the driving reported for the day before interview (table 4), approximately two-thirds (67.9 percent) of the drivers had driven an average of 34 miles on the day preceding their questioning. Variations are shown in the proportion of drivers who drove and in the mean number of miles driven according to the day of the week.

The number (33.9) of mean daily miles driven is in close agreement with the estimated annual exposure of 7,750 miles for the members of the study population (this estimate was determined from the data presented graphically in figure 2) and compares well with the national average of 7,800 miles estimated for 1953 (7).

The agreement can be demonstrated in this fashion: If 33.9 miles are driven daily by 67.9 percent of the study population, then the entire group of drivers drives an average 23 miles a day. Multiplying 23 by 365 (the number of days in a year) yields approximately 8,400 miles for an estimated year of driving.

### Discussion of Values

The foregoing material illustrates methods for gathering and assaying epidemiological data about selected characteristics of automobile drivers that may be of importance in contributing to traffic accidents. The data also serve as a basis for estimating the amount of study material needed to determine reliable accident rates according to relatively well-defined characteristics in the general population. On the basis of these preliminary results, we consider the epidemiological approach applicable to a study of traffic accidents.

The validity of several steps in the application of the method to traffic accidents has been reviewed. To summarize briefly, the sampling procedures employed yielded a population whose attributes were comparable with those described in the 1950 census and also were comparable, with respect to age, to a sample of driver licenses issued by the State bureau of motor vehicles. Inquiry concerning exposure to traffic accidents was found to yield results comparable with data from other sources.

In addition to serving as an illustration of the epidemiological method, some points in this report mark out unequivocal differences in driving experience and exposure in the general population. Almost twice as many men (78 percent) as women (42 percent) drive an automobile. The exposure to traffic accidents in number of miles driven per year for men is approximately 6 times that for women. Marked age-sex differences are seen, both in the proportion of drivers and the amount of annual driving done in a year. Such variations as these offer strong argument for a critical examination of various groups within the driving population as one phase in the search for hazardous drivers.

A measure of the reliability of obtaining accident reports in interviews is apparent from the data shown in table 1. Only some two-thirds of the individuals questioned related the story of accidents that they had previously reported at the time of accident. This measure of agreement represents a lower degree of reliability for interview material on the subject of an accident than that encountered on such topics as exposure and occupation. Improvements in interviewing techniques might increase the yield from this source.

It is not essential, however, to obtain information on an accident from the respondent in the interview so long as official machinery exists for this purpose. Accident reports on file in the bureau of motor vehicles can serve as the sole source for the numerator. Computing accident rates from this secondary but official source should introduce no crucial bias. The study sample, of course, should be of sufficient

size to compensate for the proportion of accidents learned at interview only.

Deserving of mention is the encouraging frankness encountered during the interviews on subject matter ordinarily considered touchy. Information was voluntarily given by most individuals on the matter of drinking, speeding, license suspension, and, in spite of the fact that the interviews were for an automobile accident study, on various physical disabilities and chronic diseases.

A few individuals interviewed did not state their age; a few did not state exposure. Thirteen men and 35 women did not state the number of miles driven. These omissions, which account for the variations in the study population from table to table and chart to chart, result from two factors: The omissions were not discovered soon enough after the interview to be rectified, and the question on exposure was apparently a difficult one for some persons to answer accurately. Interview techniques and questions especially developed to arrive at the estimate of exposure would help respondents supply an accurate figure.

We recognize that information on accident rates related to fairly well defined, stable characteristics may be rewarding for only a portion of accidents. Many accidents may be more closely related to very fleeting human attributes such as temporary emotional tensions. These, of course, present special, complex problems for study and validation.

If we had studies based on populations of suitable size, we could look for answers to such questions as: To what age group among the general population should special efforts be directed with regard to the screening and retraining of automobile drivers who have had accidents? What is the part of the physically impaired person in the accident problem? Of the deaf individual? The intoxicated driver? The habitual speeder? The slow driver?

We have shown that the epidemiological method of evaluating certain characteristics of drivers and other important aspects of the traffic problem can be expected to provide critical results expressed in convincing accident rates. As a result, the New York State Health Department has been sufficiently encouraged to plan a traffic investigation, greater in scope

than the Saratoga Springs study, in collaboration with other agencies concerned with the problems of traffic safety.

Two refinements not employed in the Saratoga Springs study will be made in future attempts to define accident-involved individuals. First, accidents that are manifestly the result of the operation of a defective vehicle or of an environmental hazard will be excluded from consideration in those instances where the judgment of the driver is not involved. Second, responsibility for an accident may be fixed for a group of individuals in order to define the accident-susceptible individuals more accurately.

### Summary

A method for determining motor vehicle accident rates for groups within a general population has been tested in a preliminary manner by means of home interviews of a sample in a New York State community. It is suggested that, given sufficient data, accident rates can be determined for well-defined population groups which would assist considerably in providing direction and impulse for accident prevention activities.

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# *The State of the Nation's*

public  
health  
services

**Abridged reports from the 54th Conference of the Surgeon General of the Public Health Service and the Chief of the Children's Bureau with the Association of State and Territorial Health Officers, the State Mental Health Authorities, and the State Hospital and Medical Facilities Survey and Construction Authorities, November 6-12, 1955, Washington, D. C.**

## Opportunities For Nationwide Cooperation

**1** By Marion B. Folsom  
Secretary of  
Health, Education, and Welfare

This is my first opportunity to meet with a group of State officials whose work is closely connected with the work of the Department of Health, Education, and Welfare. It is an opportunity I deeply welcome. I know the

kind of wisdom and experience and integrity you bring to the advancement of public health. And I know the value of meetings of this type, where people may work on common problems, exchange knowledge, and perhaps come up with new ideas for progress.

It is evident that the greatest progress is made in public health when there is closest cooperation between local, State, and Federal officials. Coordination with State health officers is essential if the Federal Government is to do its part effectively. State health officers are close to public health needs and problems. They know at first hand what resources are available. For these reasons, and others, your advice is especially valuable in the early planning stages of any nationwide public health program.



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It is evident that the greatest progress is made in public health when there is closest cooperation between local, State, and Federal officials. Coordination with State health officers is essential if the Federal Government is to do its part effectively. State health officers are close to public health needs and problems. They know at first hand what resources are available. For these reasons, and others, your advice is especially valuable in the early planning stages of any nationwide public health program.

The public health grant program is one of the fields which presents an opportunity for cooperation to provide better health services. Grants-in-aid are extremely useful tools, and like other tools, they need to be improved and modernized from time to time to meet changed conditions and to be more flexible in meeting the needs of each State and Territory.

Just as our programs must keep pace with growth and change, so must our staffs in public health agencies. Yet today, when the potential benefits of public health services are greater than ever before, many State and local health departments are hampered by shortages of trained personnel. Health officers can do much to help solve this problem, as you recognize. There is, for example, an obligation to make more training available to those already on the job. There is also general agreement that the Federal Government has a responsibility in this field. In addition to the programs for traineeships in public health and for increased training of nurses which are proposed, I would welcome suggestions and recommendations from this group as to other ways in which the Department can be helpful.

Now, a word about the allocation plan for poliomyelitis vaccine. It has been, from the beginning, a good example of the type of State and Federal partnership that makes for progress. The executive committee of the State and Territorial Health Officers Association was represented at all the early planning conferences. It played an important role in the development of a workable system of voluntary controls.

Currently, we are depending on State health departments for detailed information and an analysis of the vaccine's performance. This is part of an evaluation of the vaccine's effectiveness which will be made by the Public Health Service's Poliomyelitis Surveillance Unit in Atlanta. Already we have preliminary reports from 11 States covering almost 5 million children. The scientists say these reports indicate the rate of paralytic poliomyelitis was reduced about 75 percent among vaccinated children, as compared with unvaccinated children in the same age groups.

The poliomyelitis vaccination program is an example of widespread application of new

medical knowledge. In the 8 months since the effectiveness of the vaccine was first announced and was licensed for general use, the Public Health Service has released enough vaccine to give 2 injections each to more than 12 million children.

Out at the National Institutes of Health, at other Public Health Service laboratories, and through the research grants program, we are searching for answers to the other cripples and great killers. We still have much to learn about cancer, mental illness, and heart disease. There are possibilities for great benefits to humanity through more research.

It is equally true, however, that we are not yet fully applying the knowledge we already possess. Much more can be done now to prevent disease, to mitigate its disabling effects, and to rehabilitate its victims. Finding ways to do these things, of course, is not easy. There are fiscal problems, personnel problems, problems of public understanding and acceptance, to mention only a few.

But we do share the important essentials—agreement on goals, on principles, and on the ways of working together. We have every reason, therefore, to make steady progress.

In this spirit, I wish you well in the important work you are doing and pledge you all the help that we in the Department are able to give.

## The Wide Spectrum Of Our Health Services

2 By Leonard A. Scheele, M.D.  
Surgeon General of the  
Public Health Service

In his monograph, "The Cost of Sickness and the Price of Health," published by the World Health Organization, Dr. C.-E. A. Winslow writes:

"Progress made in the public-health sciences during the past half century has made it clear

that the heavy burdens of disease can, in large measure, be lifted by the application of scientific knowledge already available; and each year the results of public-health research are broadening the area of possible control."

To most health workers in this country, this statement may seem to be "old hat." We say it again and again—to ourselves, to our colleagues in public health and medicine, to our law-making and appropriating bodies, to our superiors wherever we work, and to the citizens we serve. But we must not allow repetition to dull our senses.

In this country especially, we must keep ourselves keenly sensitive to the "broadening area of possible control." We have gone far in the application of knowledge to the control of diseases which formerly imposed enormous burdens on our people. Some of us here have been in public health work long enough to have witnessed the spectacular decline and virtual disappearance of some of these diseases in our country. Typhoid fever, diphtheria, smallpox, yellow fever, malaria, pellagra, hookworm: the list is long, the accomplishment great.

Success has its perils, however; and one of the most insidious is that our very accomplishments can dazzle us to the point of blindness: blindness to the fact that "each year the results of public health research are broadening the area of possible control." Each year, mind you.

If we are not alert to these rapid advances, if we are not ready and willing to apply the new knowledge as earnestly as we applied the old, we may soon find that we are behind even in our application of "available" knowledge and that public health science again is way ahead of us.

Some health administrators may feel that our major problems today will not yield to the same type of attack that has been suitable for communicable disease control. But we have proof that the public health approach can be equally effective elsewhere. The dramatic reductions in maternal and infant mortality required new specific techniques, but the broad public health approach was the same. Severe nutritional deficiencies, such as pellagra, have yielded to public health attack.

We should recall, also, that our predecessors did not wait for the perfect control techniques against infectious diseases. With enthusiasm and determination, they set out and applied what they had.

Some of the tools they used at first—and used with considerable effect—would no doubt be rejected by public health workers today as too crude, too difficult to apply, too costly, or not effective enough. Subsequently, high precision tools of remarkable specificity were developed for the prevention of some infectious diseases. It may be that this high precision in one field of public health effort has made some of us overly fastidious in our consideration of less specific techniques now being brought forward as possible means of attacking numerous major health problems of the present era.

There is certainly a tendency to be skeptical about or reluctant to the intensive application of new knowledge in some areas—especially if application involves change in our traditional patterns of thought and public health organization.

A few years ago, for example, I stated that improved techniques of case finding and the availability of streptomycin and para-aminosalicylic acid placed health agencies in a position to wage a new offensive campaign against tuberculosis. I said that within a generation, we could reduce tuberculosis to a minor cause of death and disability in the United States. The reaction of some health workers to that statement was skeptical. Fortunately, many others agreed. Since then, the advent of isoniazid has brought my earlier prediction closer to realization.

Our health agencies must not refuse to accept the new life-saving promises of science. The American people do accept those promises. And they will find ways to bring about their fulfillment, even if it means creating new agencies in our States and cities, because their health departments have become enmeshed in their traditional programs and are not ready to move ahead.

The American people have given their health agencies ample evidence of their enthusiasm and acceptance. They are supporting health programs with tax funds and personal donations to a greater extent than ever before. They

are not concerned, however, with the perpetuation of nonproductive enterprises. They are patient—sometimes too patient—but in the long run, they will support only those organizations that are trying to help them meet the problems that most concern them.

## Finding Community Needs

We in public health are inclined to take a "mother-knows-best" attitude toward our communities in determining what those critical problems are, and in deciding which services shall be developed. For official health agencies, this attitude is natural to a certain extent, since State and local health departments have long had the legal responsibility to keep track of sickness and death, and they are supposed to know what the problems are and how to solve them. In the voluntary agency, decisions with respect to services are naturally made by leaders who are personally concerned with the specific objectives of the agency. But the official and voluntary health leaders comprise a very small part of the community. Thus, health agencies need to find ways of drawing the public closer in the process of determining issues that affect the whole community.

We would like to think, for example, that "health" has as high priority for the entire adult population as it has for us. Preliminary interviews of a small group in one community showed that the only adults who gave "health" first priority were those who have children, or have been ill recently themselves, or have a relative with long-term illness. Actually, these people comprised only 20 percent of all persons interviewed.

In seeking guides to the public's health needs, a fresh look at our mortality and morbidity data might be enlightening. Dr. Selwyn D. Collins and his co-workers, in the Public Health Service, have recently published a provocative document: *Major Causes of Illness of Various Severities and Major Causes of Death in Six Age Periods of Life*. The study is based on five Public Health Service surveys of illness, dating back to 1928.

Here are a few of the revelations in this recent review of our Nation's health status.

Serious mental disease, mental deficiency, and

neurological disorders account for the highest disability rates in one of those supposedly "healthiest" age groups, our school children, 5 to 14 years of age. The same diseases account for the highest rates in youth (15-24), young adults (25-44), and the middle aged (45-64).

Although diseases of the heart are the first causes of death in each age group from age 25 onward, they do not account for serious disability rates until age 45 years and over.

Many health agencies have apparently lost interest in influenza and pneumonia, the common cold and other minor respiratory ailments. The Conference of State and Territorial Health Officers, for example, has adopted only two recommendations on any of these infections for nearly two decades; and these were with respect to influenza virus studies. Yet in frequency, these diseases outrank all other causes of disabling illness in every age group, from birth to old age. In old age, influenza is exceeded only by diseases of the heart in frequency of disabling cases and bed cases. It is significant too that for children under 15 the first cause of hospital admissions is tonsillectomy, a surgical procedure commonly recommended as a result of respiratory infections.

Dr. Collins writes: "Death has no time dimension; even if the duration of the last illness is tabulated, the data on the death certificate give no idea of the frequency or extent of the many nonfatal illnesses that may have preceded the final illness." I would add that not only are the death certificates mute, but science is also silent about the relation of our lifetime experience with nonfatal illnesses to the occurrence of the final illness.

There is great research interest in these problems today; many stimulating studies are being conducted that may give some answers. Whatever the answers may be, it is clear that the basic principle of public health—prevention—can reduce substantially the assaults of nonfatal illness, if we do but apply this principle wherever science has given us techniques and wherever there is an opportunity.

## A Challenging Era

We in public health have demonstrated that massive attacks on specific diseases will pro-

duce results. A massive attack requires a massing of resources: funds, personnel, equipment, materials, and facilities. When the public has been strongly motivated to provide this massing of resources, then prevention, control, and, eventually, eradication can follow. In the chronic illnesses of later life, some prevention and considerable extension of life can be accomplished in a massive attack.

The poliomyelitis vaccination program is the most recent example of what can be done when strong interest and an adequate budget permit a concentrated attack on a preventable disease. A voluntary health agency has had the magnificent courage to channel the public's emotional drive against poliomyelitis into the research and development of the first effective preventive vaccine for paralytic poliomyelitis. The public, thus strongly motivated, has made possible through their representatives in Congress a nationwide program that will not only attack poliomyelitis, but will also strengthen State and local health agencies in basic skills to deal with other viral diseases.

A similar massing of resources in our States and communities could speed the eradication of some diseases which are already declining rapidly and could bring about substantial reductions in deaths and illnesses due to diseases which have shown few signs of retreat.

For example, there is hope for chemoprophylaxis of tuberculosis. The tuberculosis research staff of the Public Health Service has demonstrated that oral isoniazid, administered daily, is effective in preventing tuberculosis in experimental animals. Clinical trials with isoniazid have been initiated for the prevention of tuberculous meningitis and other complications in newly infected children. Twenty-five pediatric centers are cooperating with the Public Health Service and the National Tuberculosis Association in the first large-scale, controlled study using an antimicrobial drug as a prophylactic agent against tuberculosis.

The effectiveness of isoniazid as a general preventive of tuberculosis depends on the outcome of this study and on controlled trials in other and larger population groups. Persons who react positively to tuberculin and persons who exhibit suspicious shadows on X-ray films may be the first to benefit from the preventive

and curative properties of isoniazid. The drug can be produced easily in large quantities at a very low cost.

Definitive treatment of tuberculosis can now be administered by the private physician to the patient at home or in the clinic, but with home treatment great care must be taken to prevent the spread of the disease to family members and the community at large. Thus, the supervision and followup of home care patients will become an increasingly important activity for health departments. The need for establishing criteria for the selection of home care patients is also intensified, since in many cases it is the health department's legal responsibility to decide whether the patient must be hospitalized.

Directors of tuberculosis hospitals are eager to make sure that adequate followup is available for patients discharged under isoniazid therapy. In one State, a Veterans Administration hospital reimburses local health departments for periodic X-rays and sputum tests of patients who have been discharged under isoniazid therapy. The health departments provide followup services and thus are able to work with the families of these patients. This arrangement, in which the local health department serves as liaison between patient and hospital, has been approved by the local medical societies.

The Public Health Service is developing a similar program in Alaska. We have contracted with the Territorial health department to conduct an experimental tuberculosis case-finding and home care program as a part of the Alaskan Native Health Service for which we are now responsible.

We can no longer say that the development of home care programs is a future charge on health departments. The time is now. Not only has the entire pattern of tuberculosis control changed, as has syphilis control, the discharge of mental patients under treatment with new drugs is a present problem. The return of mental patients to the community is placing important responsibilities on health departments and mental health authorities not unlike the demands for followup and supervision in the extensive use of isoniazid.

Every State and Territory is now in a position to reduce rheumatic heart disease substantially as a cause of disabling illness and pre-

mature death, and at the same time reduce markedly the onset of rheumatic fever. Progress against these diseases can be added to the long list of public health accomplishments even with future improvements in available techniques.

The recommendations of the Committee on Prevention of Rheumatic Fever and Bacterial Endocarditis of the American Heart Association have the full endorsement of the Public Health Service and the Children's Bureau. We are cooperating actively in the promotion of antibiotic treatment of all cases of streptococcal infection and chemoprophylaxis of recurrent attacks of rheumatic fever.

Public and private agencies have made a good start. They are sponsoring rheumatic fever clinics in more than 600 communities. But if we are to call a halt to rheumatic fever and rheumatic heart disease, we must have thousands more cooperative projects. Through these clinics, practicing physicians, schools, and parents can obtain many necessary supporting services for rheumatic children. Psychiatric advice, educational and vocational counseling, social service, and public health nursing follow-up are made available. Consultative services for the physician in the diagnosis and management of rheumatic fever and rheumatic heart disease also are provided.

A direct attack on the mortality from cancer of the cervix and uterus can now be made. The very promising and challenging results of our demonstration of the cytologic test in large groups of women at Memphis, Tenn., and elsewhere are especially interesting from the point of view of public health administration, in terms of cost, personnel, time, and ease of performance.

### Evaluation Studies

These and many other advances in medical and public health science make it essential that health agencies critically examine their present pattern of organization of community services. In marked contrast with public enthusiasm for every advance in the health sciences, public acceptance of the traditional public health structure—the local health unit—seems to have reached a passive state in many com-

munities. People are neither militantly for nor against it. No community institution can be in a more perilous condition than when it commands only passive acceptance.

It is time we found out the basic causes of this indifference. Fortunately, in recent years, there has been a stirring of interest in the evaluation of public health programs and services. The Kellogg Foundation has expressed an interest in the support of research projects in this area. The Public Health Service wants to assist the States and Territories in whatever ways seem feasible. Possible approaches include studies conducted by our own staff; assignment of personnel to assist in State evaluation studies; participation in cooperative projects; and research grants to independent investigators. None of these approaches is exclusive; we should like to know your wishes.

Evaluation studies will require different approaches from those commonly employed in the study of disease behavior or in the rating of community health on a predetermined scale. The intent is to study community patterns and the bases of "health behavior" both in professional health workers and in the public they serve. We shall need the help of sociologists and psychologists as well as that of epidemiologists and statisticians.

### Wide Spectrum Problems

Although at the moment we do not know precisely what are and what will be the most effective methods of organizing health services, we certainly know that public health has outgrown the "four-man health unit." New responsibilities have broadened the outlook at the State level to include some of the most stimulating challenges that the health professions have ever encountered.

To borrow a word from this antibiotic era of medicine, we must now be concerned with "wide-spectrum" health problems. The wide spectrum of public health today includes attention to the health and medical components in the broad fields of vocational rehabilitation, welfare, education, employment security, agriculture, housing, water resources, and many others.

Leaders in these fields are constantly turning to public health agencies for advice and cooperation. We, too, must turn to them, offering at the same time our best efforts in the solution of mutual problems. If public health is to go from strength to strength, we must take our opportunities to apply the concepts of prevention in some of these wide-spectrum fields.

Our relationships with our colleagues must be more than routine. If our cooperation is not more than lip service, these agencies will hire their own physicians and health staffs and ignore us. In this challenging period of history, applied science is revolutionizing the material aspects of our universe. If the incredible advances in technology are to be applied with maximum benefit to human life, we must have the widest possible range of bold, creative thinking in the social sciences and in the organizations whose responsibilities are the application of health, educational, and sociological knowledge. We in public health cannot possibly imagine that we possess all the brains, all the wisdom, all the creativity. We need our colleagues in a score of fields, as they need us.

Also, we must redouble our efforts to indoctrinate our State and local medical societies in the values of wide-spectrum health services. We must realize that for nearly a century, general practitioners have had almost no experience in the management of mental and tuberculous patients, for example. Under State laws, this has been the responsibility of the State. Now, advances in medical science are returning many of these patients to the general practitioner, who is also treating an increasing number of aged and chronically ill patients in their homes. But medical care today includes many types of service: nursing, physical therapy, and social work and other related services also must be made available to the home care patient.

Medical societies can be a most constructive influence by encouraging their members to utilize community nursing and related services in the care of these patients. Many urban communities now offer home nursing care, physical rehabilitation, and housekeeper services through the combined programs of official and voluntary health agencies. In smaller communities and

rural areas, the opportunity for organizing home nursing services presents a direct challenge to local health departments.

Plans have been developed on the west coast to provide dental care for dependent children of the members of prepayment medical care plans sponsored by labor and management groups. This experiment is of signal importance, since there is a growing demand for prepayment dental care plans covering the general population.

The difficulties inherent in the development of actuarially sound dental health insurance have been widely discussed. The demonstrations conducted by the Public Health Service in cooperation with State and local health departments and dental societies have provided valuable cost data and methodological information on the provision of dental services for children. State health department staffs may find these studies useful should they have opportunities, with State dental societies, to assist in the development of similar programs in their areas.

The health component looms large in such many-faceted social problems as juvenile delinquency, drug addiction, alcoholism, and accident prevention. Society now recognizes that ill health—physical, mental, emotional—is a major factor in producing deviant behavior. Still more encouraging is the growing acceptance, by the groups directly concerned, of preventive medicine and public health as vital parts of the total therapy of these massive problems.

Courts, law enforcement agencies, churches, schools, industries, voluntary organizations, and other groups will turn more and more to their health agencies for help, if help is offered. We should be ready and willing to contribute our best thinking and to participate actively in national, State, and local programs dealing with human behavior that is just as destructive to the individual and the community as is the behavior of an uncontrolled epidemic disease.

Some health departments have begun to explore these areas, in order to identify specific factors and to determine the role they can best play. The team approach to home accidents that has been developed by several State and local health departments, in cooperation with the Public Health Service and the Kellogg



mature death, and at the same time reduce markedly the onset of rheumatic fever. Progress against these diseases can be added to the long list of public health accomplishments even with future improvements in available techniques.

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Although at the moment we do not know precisely what are and what will be the most effective methods of organizing health services, we certainly know that public health has outgrown the "four-man health unit." New responsibilities have broadened the outlook at the State level to include some of the most stimulating challenges that the health professions have ever encountered.

To borrow a word from this antibiotic era of medicine, we must now be concerned with "wide-spectrum" health problems. The wide spectrum of public health today includes attention to the health and medical components in the broad fields of vocational rehabilitation, welfare, education, employment security, agriculture, housing, water resources, and many others.

this perplexing problem: cooperative planning and provision of services for the care of long-term patients—regardless of the causes of disability.

A new concept is emerging of the kinds of services and facilities that will be required for comprehensive care of the chronically ill, the disabled, and the aged. This concept recognizes the need for a wide variety of services and facilities, but the emphasis is on prevention and rehabilitation. The patient is viewed as a person in his home in his own community where he will receive the greatest part of his care under the supervision of his personal physician. The community remains the central factor in any plan for his care.

Application of this concept presents our State and local health departments with many opportunities to work with practicing physicians for better health of the individual, the community, and therefore, of the entire Nation.

I have mentioned some areas for work, and I am sure that you can name many more. The question before you now is "How many health departments will seize the opportunities—and when?"

## Current Trends In Child Health

3

By Martha M. Eliot, M.D., Sc.D.  
Chief of the  
Children's Bureau

For those of us in the Children's Bureau, this meeting is a high point in the year's activities. The very process of reviewing the highlights of the past year that are significant for mothers and children may suggest new activities or new ways of strengthening older programs.

The increase to \$15 million in the appropriation for the crippled children's program is evidence of the widespread interest in the handicapped child and of skillful administration of the crippled children's programs by the States.

In 32 States they have become significant community medical care programs in which the quality of service is recognized as exemplary.

To assist in the continued development of these programs, regional conferences of State crippled children's agencies have been held recently. Some of the Nation's outstanding specialists in orthopedics, epilepsy, psychiatry, congenital heart disease and rheumatic fever, hearing impairment, mental retardation, and cerebral palsy took part.

The increasing concern about long-term illness in childhood to some extent reflects changes that have been taking place in pediatric practice. With the specific agents available for treating acute infectious diseases, fewer children with such illnesses now need hospital care. Many can be treated at home or in outpatient clinics.

Consequently, chronic diseases and crippling conditions now make up a greater proportion of illnesses in childhood and account for a growing proportion of pediatric inpatients in hospitals. This increasing trend is beginning to make a reorientation necessary in the teaching of medical students and nurses and in the post-graduate work of physicians.

### Helping Crippled Children

From our experience with the administration of the State crippled children's programs we have learned much about the importance of a multiprofessional approach to the patient—an approach which considers his individual personality and stage of growth, his handicap or illness, his family and the community in which he lives, and what kind of an adult he may become. Together we have learned much about the principles and policies underlying the administration of a medical care program.

The crippled children's program has been fortunate in having the devoted support of members of the medical and related health and social work professions. Indeed, these programs could not have continued if we had not learned how to work with medical professional organizations and with the many public and voluntary organizations whose cooperation and participation are so important.

Children suffering from congenital heart dis-

Foundation, offers a valuable method for future study of the health component in highway accidents. The home accident prevention demonstrations pay special attention to the physical and psychological factors, as well as the environmental factors.

Highway engineering, improvements in motor vehicle design and construction, strict law enforcement and education combined have not sufficed to cope with the national problem of motor vehicle accidents. Death rates from this cause have increased steadily for the past 3 years.

We have not learned why the human being behind the wheel, or in the path of a car, behaves as he does. Nor have we learned what to do about his behavior when it is antisocial or self-destructive. We suspect that certain factors may be the basic "causes" of accidents.

We do know that the quality of driving is the chief cause of nearly 40,000 deaths chalked up to "motor vehicle accidents" annually, as well as an estimated 1,300,000 nonfatal injuries. More than 1 million of these nonfatal injuries result in total temporary disability, and 100,000 in permanent impairments. These facts would seem to call for action on the part of local, State, and Federal health agencies as insistently as the spread of infectious diseases.

## The Perennial Problem

The shortage of adequately trained public health workers remains critical. This is our perennial problem. Health officials are especially concerned because we are making little headway in reducing the backlog of inadequately trained public health workers. Actually, in some categories, the backlog is increasing. The numbers of sanitation and nursing personnel receiving 4 months or more of advanced training have dropped since 1947 by 68 and 62 percent, respectively.

Public health agencies at all levels must learn to utilize their highly trained personnel more effectively. Auxiliary workers can perform many functions efficiently without having the advanced training now believed necessary for many routine operations. These workers must be used much more extensively. A career in public health must be "sold" to more medical

students, nurses, and engineers. Pay scales must be made more realistic and attractive.

Despite the shortage of additional public health recruits with advanced training, health agencies, official and voluntary, should push ahead with the expansion and enrichment of their programs. This is one way to improve recruitment. No matter how many competent men and women are trained, health agencies that offer only routine jobs will always have difficulties in recruiting and especially in holding able young employees.

Our professional schools, including graduate schools of public health, are increasingly concerned with the challenges of wide-spectrum health services. They have the capacity to turn out students who want careers in organizations where they can use the new knowledge and skills they have acquired. Health agencies must make their jobs attractive to graduate students. Many times, a truly satisfying job in a challenging field will counterbalance the deterring effect of low pay.

We cannot expect young men who have received their first training in electronics, nuclear engineering, and industrial processes to be satisfied with routine sanitation operations. No more can we expect young physicians who have been indoctrinated with the new concepts of chronic disease control, medical rehabilitation, hospital administration, and mental hygiene to be satisfied with assignments only to routine immunization clinics and repetitive case finding in traditional control programs.

## Further Observations

Even though there are far more jobs to be done than there are people to do them, or funds to pay for the doing, we must take heart and go forward. It is not possible for any one organization to do the whole job. We have not yet begun to utilize all the resources that our communities may have in reserve. The health agencies can often accomplish more by being the active sparkplug and generator than by attempting to be the entire engine.

We have learned this lesson after a few years of desultory effort to control a few chronic diseases. Now we are seeking new approaches to

Last year, the lunch program reached a peak of 11 million youngsters. A special milk program, launched for the first time, resulted in an increased consumption of 451 million half-pints of milk by well over 8 million children.

## The Incidence of Prematurity

The decline in infant mortality has caused many people to look closer at the problem of perinatal mortality, that is, fetal and neonatal losses. In 1953, fatalities to infants before, during, and just after birth numbered about 162,000. These deaths were about 10 percent of the total mortality in the United States at all ages and from all causes. Much of this perinatal loss is associated with premature termination of pregnancy. About 57 percent of all neonatal deaths are in premature infants. When the small premature infant survives, chances of neurological disorders are greater than for the full-term baby whose mother's pregnancy has been free of complications.

To assist us in our efforts to reduce the incidence of prematurity, the Children's Bureau is working with the National Office of Vital Statistics, State health departments, and other groups to get more trustworthy statistics about the incidence of prematurity and the bearing of socioeconomic, familial, and clinical factors upon its occurrence.

To this end, we are working toward more complete and accurate reporting of fetal loss and for wider agreements among clinicians, public health statisticians, and directors of maternal and child health programs as to how we shall study significant events in the mother's pregnancy and in the prenatal period. We are also consulting with a number of States on their studies of prenatal mortality and prematurity.

Blindness in premature infants may soon be rare now that excessive oxygen administration has definitely been implicated in its causation. State health departments have publicized to the medical profession the conclusions drawn from the study of retrolental fibroplasia in 18 hospitals. Although the incidence of this pathological condition has dropped in numerous hospitals, more work is needed to assure a higher

degree of accuracy in the concentration of oxygen being supplied to infants in incubators. The limitation in the use of oxygen when necessary for very small infants does not seem to have resulted in a higher mortality among premature infants as was feared.

## Poison Control Centers

With accidents the leading cause of death among children, poison control centers are a new development in many cities. A committee of the Illinois Academy of Pediatrics cooperating with the Chicago Board of Health established the first center in 1954. There are centers in Boston, Cincinnati, Dallas, Durham, N. C., Indianapolis, Louisville, New York City, Phoenix, Springfield, Ill., and Washington, D. C. Poison control centers provide information on toxic household chemicals, advise hospitals on appropriate treatment, and educate parents on prevention and first aid.

## Mental Retardation

Last year I reported that parents of mentally retarded children were doing much to bring to public attention the problems they have in bringing up their handicapped children. The Children's Bureau is currently making grants to three States for special projects in this area. Other States are developing plans for diagnostic evaluation centers and for day-care centers, nursery school classes, social services, and other community resources. The Congress has expressed considerable interest in this problem and has encouraged the Department of Health, Education, and Welfare to extend its activities in this field.

Mental retardation was the subject of a discussion this year by the Federal Interdepartmental Committee on Children and Youth. Reports were presented on the current activities of the National Institute of Mental Health of the Public Health Service, Office of Vocational Rehabilitation, Bureau of Employment Security, Office of Education, and the Children's Bureau. The committee is planning a 2-day seminar on mental retardation for the spring of 1956.

case are now being treated with a success that was only dreamed of a decade ago. Today's operative techniques not only save the lives of many of these babies but give them a chance to grow up normally.

At the Second World Congress of Cardiology (1954), two-thirds of 244 children helped by the Blalock-Taussig operation were reported to be maintaining their gains 5 to 8 years later. The improved operative procedure makes it possible to repair defects inside the hearts of babies less than a year old and of older children as well.

Among the newest of the special projects under the crippled children's program are those in California and Michigan for the development and use of artificial hands. The grant to Michigan is enabling the Crippled Children's Commission to serve as a regional resource, extending help to many children in the mid-west. This program, like the one for children with congenital heart disease, is another example of how the benefits of research, especially those of such highly technical and costly types as these, can be made available to children in rural areas through organized programs administered by public agencies.

## School Health Services

Two significant conferences on school health were held in October 1955: the Fifth Annual National Conference on Physicians and Schools and the National Conference on Priorities for Nursing Services for School Age Children. The health of school age children will be featured at the November 1955 meeting of the American Public Health Association in Kansas City.

The Children's Bureau works closely with the Public Health Service on many undertakings aimed at improving the health of mothers and children. The Bureau, the Public Health Service, and the Office of Education, through the Departmental Committee on School Health, review ways in which we can be of assistance to State health officers.

This heightened interest in school health services, as in education itself, is largely a result of pressures brought about by the increase in the child population.

The United States has 37,277,000 children of school age, children between 5 and 17 years of age. All need basic health care, including comprehensive medical and dental examinations at periodic intervals with special consultation and diagnostic service as required; immunizations against contagious diseases; continuous observation by parents, teachers, nurses, and others to detect early deviations from the child's usual physical, nutritional, or emotional well-being; frequent tests of hearing and vision; and the correction and treatment of physical and mental defects and conditions, particularly those likely to interfere with educational progress and normal growth and development.

Case finding of physical handicaps has value only to the degree that parents obtain the necessary medical attention for their children. That many children do not receive corrective follow-up before adulthood is attested by the rejection for medical reasons of 46 percent of selective service registrants between 1948 and 1955.

Studies have repeatedly brought out that children do not receive the treatment recommended by school health services because of the parents' inability to pay for care, the lack of appreciation on the part of parents and children of the importance of taking the necessary steps to obtain care, and the inadequacy of resources to provide diagnosis and treatment, particularly of a specialized nature, in rural areas and in the new suburbs and communities that spring up near rapidly expanding industries.

## School Lunch Program

The National School Lunch Program continues to improve the health of vast numbers of children. We are well aware that the nutritionists in the State health departments, the maternal and child health divisions, have made real contributions to this program.

The 1955-56 program, enriched by grants and surplus foods from the United States Department of Agriculture, is expected to exceed \$600 million in money value, half of which will come from the children who consume the low-cost meals and milk and close to a third, from the Federal Government.

the importance of understanding the factors influencing personality development.

The conference discussed school health services as a resource for the prevention of delinquency and emphasized these points:

- Early identification of high risk children.
- Spotting symptoms of aggressive or withdrawn behavior (stealing, truancy, not working to capacity, reading retardation).
- The need for child guidance services in the health programs in schools.
- The use of ancillary personnel without formal training for counseling.
- The need for more emphasis on the emotional component of growth and development in the training of all professional persons.
- Ways in which personnel can help prevent situations of crisis proportions and provide first aid when a crisis arises.
- Responsibility of health personnel for taking action.

A symposium on juvenile delinquency was a prominent feature of the recent annual meeting of the American Academy of Pediatrics.

The symposium was directed particularly to the health aspects of the subject, to the role of the practicing pediatrician in prevention and treatment, to the importance early relationships in the family have for personality development. Frequently, the social and moral environment makes it difficult for children to establish satisfactory relationships between themselves and the world in which they live.

In closing, I would like to return to the matter of the responsibility of the State health departments for maternal and child health and crippled children's services. These two programs, when in one State agency or when closely coordinated in separate State agencies, contain all the elements necessary to provide adequate health care for children. It seems to me that possibly these services and facilities could be used more effectively to the great advantage of many children known to other State agencies, particularly agencies providing for welfare and education.

Earlier, when I referred to the current interest in school health services, I did not speak specifically of the children for whom the child welfare programs are responsible—the children

in institutions, in foster family care, or in their own homes—or of the large group of dependent children who are deprived of parental support and in receipt of public assistance, or of children dependent on local relief. No doubt various lines of cooperation exist in many States and communities. I bring this question to your attention now so that you and your staffs may perhaps renew your consideration of whether the best use is being made of your resources.

## Community Air Pollution, A Developing Health Problem

4

By Justin M. Andrews, Sc.D., LL.D.  
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Public Health Service

Until recent years community air pollution in the United States has been regarded as the cause of a series of local problems susceptible to local solution. However, the expansion of population and industry in the past few decades has combined hundreds of air pollution sources into composite air pollution areas with which individual local authorities cannot cope on the basis of present knowledge. These areas have developed air pollution problems of enormous complexity involving more than one State in some cases and, in many instances, a large number of uncoordinated legal jurisdictions.

The simultaneous outpouring of many gases, fumes, and particulates into the Nation's ambient atmosphere, and the subsequent interactions and combinations of these pollutants in the air have damaged vegetation, livestock, physical structures and other materials, and have decreased property values. Among exposed populations, it has caused untimely deaths, unnecessary suffering, acute and prolonged irritation.

If permitted to continue without restriction, community air pollution may be expected to

## Migratory Workers

Following the East Coast Migrant Conference last year all of the 10 States in the east coast migrant stream have been active in different ways.

Pennsylvania is developing day-care centers in Potter County.

Florida is completing the first stage of a special study of the health problems of migrant families as recognized by the migrants themselves. The study will provide basic information which should be useful in making realistic plans to extend help to children and their families.

Colorado and Idaho have special health projects for caring for migrant families.

Some of the State health departments are using maternal and child health and crippled children's funds or State funds to increase health services in areas to which migrants come. States have been ingenious in finding ways of overcoming the staffing problem at peak seasons, for example, by employing medical students in the summer, high school science teachers as extra sanitary inspectors, and by assigning school nurses to assist the regular public health nurses in the summer term.

The President's Committee on Migratory Labor has completed its first year of coordinated Federal activity. In October 1955 this Cabinet-level committee laid out a program for the coming months. Among its activities it will seek ways of easing residency requirements for eligibility for service—requirements which disqualify migrants in many programs, especially welfare and medical care. Another activity will be studies of housing needs.

## Protecting Adoptions

Problems of unmarried mothers and the adoption of children have long been a major interest of the Bureau. The most publicized problem is that of the number of children being adopted without minimum protections, the babies who are sold to adoptive couples. The idea of selling babies is intolerable, but the practice continues.

The Children's Bureau has sought the knowledge of people who have had contact with one or more of the parties to a black market adop-

tion. The line between a black market placement for money and many others where money does not change hands is very fine indeed. The hazards can be just as great for the child, his natural, and his adoptive parents.

We have asked some preliminary questions regarding the availability and adequacy of medical care for unmarried mothers, about legal requirements and restrictions on community services to girls who have left their home to lose themselves in a big city, about the availability and adequacy of social services, about certain policies and practices of adoption agencies that seem to facilitate or hinder the meeting of the needs of the unmarried mother and her child, about agency practices regarding the couples who want to adopt children.

In June 1955 the Bureau held a conference with 31 national agencies and organizations to discuss the need for protecting children in adoptions. The Academy of Pediatrics, the Academy of General Practice, the American Hospital Association, the American Public Health Association, the Academy of Obstetrics and Gynecology, the Association of State and Territorial Health Officers, and legal and social agencies were represented.

The conference brought out the need to concentrate on providing medical and social services acceptable to the unmarried mother, clarifying the responsibilities of the professions concerned in adoptions, and securing legislation which will assure legal safeguards to protect the child, his natural and adoptive parents.

The Bureau employs a special consultant on unprotected adoptions and services to unmarried mothers.

A study of the problems involved in providing medical care to these mothers is being contemplated.

## Juvenile Delinquency

In May 1955 the Children's Bureau called a conference on health services and juvenile delinquency in which State health department personnel participated. It was one of the few occasions when a conference on delinquency has focused on the relationship of delinquency and child health and public health. The discussion centered on the parent-child relationship and

the general philosophy of the ad hoc committee, as indicated above.

## Air Pollution Control Act

On July 14, 1955, the President approved Public Law 159, following its passage by the Congress. The Air Pollution Control Act authorizes the Surgeon General of the Public Health Service, under the supervision and direction of the Secretary of Health, Education, and Welfare, to conduct a program of research and technical assistance relating to air pollution, with an appropriation not to exceed \$5 million annually for each of the fiscal years 1956 through 1960.

The act declares "the policy of Congress to preserve and protect the primary responsibilities and rights of States and local governments in controlling air pollution, to support and aid technical research, to devise and develop methods of abating such pollution, and to provide Federal technical services and financial aid to State and local government air pollution control agencies and other public or private agencies and institutions in the formulation and execution of their air pollution abatement research programs."

This is a very broad act which recognizes that air pollution may endanger health and welfare, injure agricultural crops and livestock, damage property, and create hazards to air and ground transportation. Thus, it is not limited to health in its implementing provisions.

Specifically, the Surgeon General is authorized or enjoined, with respect to air pollution and its control, to—

Cooperate with governmental (Federal, State, and local) and private agencies, institutions, industry, and other organizations in preparing research programs and in undertaking joint studies with any such groups.

Encourage cooperative activities by State and local governmental agencies.

Collect and disseminate information.

Conduct research in the Public Health Service and support and aid the conduct of research by State and local air pollution control agencies and other agencies and institutions, and to publish the results thereof.

Conduct investigations and make surveys

concerning specific problems when requested by any State or local air pollution control agency, and publish reports of findings.

Make grants or let contracts for research, training, and demonstration projects to State and local government air pollution control agencies, and other public and private agencies and institutions, and to individuals.

A supplemental appropriation to implement Public Law 159 was passed also at the last session of Congress. This appropriation plus funds from the Public Health Service regular appropriation makes a total of \$1,785,000 available for community air pollution research and technical assistance during fiscal 1956.

## Program Under Way

The technical assistance program has been initiated. Personnel have been assigned to assist the Los Angeles Air Pollution Control District through the California State Department of Public Health. Similar assistance has also been extended to Louisville, Ky.

Requests for extensive investigations have been received from 28 State governments and local communities as of November 1, 1955. These requests do not include the numerous calls for consulting services received from many other different parts of the country.

Short courses in the technical aspects of air pollution control are scheduled to be held at the Robert A. Taft Sanitary Engineering Center of the Public Health Service in Cincinnati. No funds for training or demonstration grants are available during fiscal 1956.

The research activities planned for this fiscal year will be carried on (a) directly by the Public Health Service in Cincinnati both at the Sanitary Engineering Center and at the Occupational Health Field Headquarters, (b) by other agencies of the Federal Government, and (c) by Public Health Service grantees and contractors.

At the Sanitary Engineering Center, the nationwide, aerometric survey begun approximately 2 years ago will be expanded. Preliminary estimates of classes and determinations of amounts of particulate loadings have been obtained from air samples collected on daily and weekly schedules in more than 30 representative



cause increasing hazards wherever it occurs. Such harrowing episodes as those which took place in Glasgow in 1909 and 1925, the Meuse Valley of Belgium in 1930, London in 1948 and again in 1952, Donora, Pa., in 1948, and in Poza Rica, Mexico, in 1950, signify what may occur in many other places, unless means can be found to contend effectively and economically with aerial effluents which threaten life and property.

## Ad Hoc Committee

Public and official attention was again directed to this menace during recent years by the disturbing occurrences of community air pollution, or "smog" as it is locally known, in the Los Angeles area. The Congress was concerned not only about the California situation but about the evidence of increasing atmospheric pollution in other States.

At the informal suggestion of the White House, the Secretary of the Department of Health, Education, and Welfare invited the heads of certain other Federal agencies and departments—Atomic Energy Commission, Agriculture, Commerce, Defense, Interior, and the National Science Foundation—to nominate policy level representatives to an Ad Hoc Interdepartmental Committee on Community Air Pollution.

The first meeting of this group convened under the chairmanship of the Surgeon General of the Public Health Service on November 16, 1954. Several other conferences were held thereafter, some of them with technical deputies from the various agencies.

For its own purposes, the committee developed the following definition of community pollution:

"Community air pollution is the presence in the ambient atmosphere of substances put there by the activities of man in concentrations sufficient to interfere directly or indirectly with his comfort, safety, or health, or with the full use and enjoyment of his property. In general, it does not refer to the atmospheric pollution incident to employment in areas where workers are employed, nor it is concerned with airborne agents of communicable disease, nor with overt or covert acts of war."

The committee reviewed the statutory bases for the interest of the participating agencies and appraised existing knowledge pertaining to community air pollution. Members were unanimous in the conviction that existing gaps in essential information could be filled only by coordinated research specifically directed to the problem by competent medical, scientist, and engineer investigators. They expressed the belief that the determination of basic criteria of air cleanliness in the community atmosphere is a public responsibility and that such criteria must be based on definitive, scientific data and considered in relation to all the pollutants present.

The committee recognized that the funding of comprehensive studies as a basis for these determinations and for the establishment of facts concerning nonindustrial community air pollution was beyond the usual resources of single States. In view of the national interest, therefore, the committee considered that it was a proper responsibility of the Federal Government to provide leadership and supplementary means in solving these and related air pollution problems, making the most effective utilization of existing competencies and facilities, and inviting and encouraging as much research as can be performed or supported by States, industry, and other agencies.

As to the role of Federal and State-local governmental agencies in controlling and regulating community air pollution, the committee recommended the designation of the Department of Health, Education, and Welfare to sponsor and support pertinent legislation and to direct a Federal program in this field; and the establishment of an interdepartmental committee on community air pollution on a continuing basis. The committee also suggested the scientific areas in which funds should be assigned if appropriated by Congress. This information is contained in a report released on April 8, 1955.

In the meantime, several bills, amendments, and joint resolutions pertaining to air pollution had been proposed in Congress. In reporting on them to the congressional committees concerned, the Secretary of Health, Education, and Welfare made suggestions consistent with

of contract research to provide information concerning the health effects of subacute exposures to pollutants suspected to be harmful. This is probably the most important single fact to ascertain. Thus far, it has been the most elusive since most air pollution control ordinances are written on the assumption that freedom from community air pollution will be healthful.

It is hoped that organ function tests, especially pulmonary and cardiovascular, can be devised for use on a mass basis. Such tests might be applied, according to conventional epidemiological patterns, to population groups comparable in all important respects except for their exposure to high or low levels of specific air pollution.

Similarly, chest X-ray surveys may be made along epidemiological lines to see whether lung cancer is more prevalent in populations exposed to continued, high levels of air pollution.

Efforts are also planned to determine whether tissue culture techniques offer a more sensitive indication of the toxicity of air pollutants than do intact test animals.

Contract research will be employed by the engineers for the development and construction of special equipment such as automatic, recording air analyzers capable of measuring several air pollutants simultaneously.

These are the tentative directions in which the air pollution program is now headed. As new facts become available, more of the research will probably shift from emphasis on causes and effects to ways and means of preventing or controlling community air pollution. In time, more of the funds may be used for demonstrations and training than for research.

In view of the complexities of the problems involved and the frustrating experiences in control efforts thus far, it seems unlikely that immediate or short-time results can be expected. The ad hoc committee was of the opinion that at least 2 years would be necessary to build up to the desirable level of research activity, and that 5 years of intensified effort at the maximum budgetary level specified by Public Law 159 would be required to produce research findings of major significance.

# Research Factors In the Control Of Uterine Cancer

# 5

By Raymond F. Kaiser, M.D.  
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Since cancer presents no symptoms in the early stages, the development of a case-finding method for discovering uterine cancer in a really early stage of the disease represented a difficult research undertaking.

Thanks chiefly to the research efforts of Dr. George N. Papanicolaou, we have such a procedure today. This is the cytologic technique for examination of exfoliated cells in vaginal smears. The technique is based on the fact that since cancer cells do not adhere closely together, and consequently shed readily, with proper staining they can be distinguished microscopically in smears of vaginal secretions.

## Papanicolaou Test

The Papanicolaou technique has been a long time coming to its present acceptance for a number of reasons.

The idea of studying the exfoliated cells in various secretions of the body is not new. Examination of the vaginal fluid was first performed by Pouchet more than 100 years ago. His interest, however, and that of many investigators who followed him, was related to analysis of the normal human sex cycle and to the problems of sex physiology.

Papanicolaou was also doing research in the field of sex physiology when in 1923 he first applied cytology to the diagnosis of uterine cancer. His new discovery was duly reported in the literature, but, despite this early recognition of the possibility of diagnosing uterine cancer by this means, the interest of clinicians in the potentialities of this diagnostic method was not aroused.

communities. These include both urban and rural areas. Inorganic assays and quantitative analyses of certain organic constituents are made of the present particulate collections, and it is planned to supplement these by routine determinations of some of the nonparticulate pollutants (gases and fumes) in the near future.

At the Occupational Health Field Headquarters, work is already under way in determining the physiological and toxicological effects of certain chemicals, such as ozone, oxides of nitrogen and sulfur, and complex hydrocarbons known to be present in smog.

Certain research problems in air pollution can be studied more advantageously and economically by other Federal Government agencies in addition to their regular activities because of staff competencies and special facilities which they possess. Thus, arrangements have been made to transfer funds for special projects to three such agencies.

The United States Weather Bureau will make basic studies of the meteorological factors governing diffusion and dispersion of pollutants in the atmosphere and develop techniques of forecasting critical meteorological conditions in relation to air pollution.

The National Bureau of Standards will develop methods for sampling and analysis of certain air pollutants about which little is known and study their chemical and physical nature and the reactions at sources and in the atmosphere which may combine, split, or otherwise modify them, creating different and perhaps more or less harmful compounds.

The Bureau of Mines, Department of the Interior, will investigate methods of incineration of combustible wastes, evaluate sulfur dioxide removal processes, determine the composition of and changes in automobile exhaust effluents, and participate in special community investigations.

Arrangements also are being made for the Veterans Administration to undertake statistical studies of their physical examinations, case histories, morbidity and mortality experience among veterans who are known to have had long residence under conditions of relatively high or low exposure to known types of air pollutants. This effort to obtain sugges-

tive clues from retrospective data concerning impairments which may ensue from chronic, accumulative exposures would require many years of watchful waiting to detect by the methods of prospective epidemiology.

A similar study, on a contract basis, is planned with the Society of Actuaries with reference to medically impaired insurance policyholders.

## Grants-in-Aid

All grants-in-aid authorized by the act are for research, training, or demonstration projects. There are no formula-type grants for general program support. Only research grants will be made during this fiscal year.

Of the \$500,000 available for research grants in 1956, approximately \$300,000 already has been committed for support of air pollution studies. Most of the research grants awarded so far have been for studies primarily related to the health effects of air pollutants. Investigations under way include broad epidemiological studies of the relation of human disease to air pollution, studies of the effects of specific contaminants such as fluorides and oxides of sulfur, and studies of physiological response to air pollutants.

It is expected that future research grant projects will include studies on the causes and prevention of air pollution as well as those concerned with its effects on health.

The Division of Research Grants, National Institutes of Health, administers the processing of research grants. The air pollution research grants program is somewhat different from similar programs of the Service. It is authorized by separate legislation which is not limited to health considerations, although these are of a high priority, but is sufficiently broad to cover any research related to the causes, effects, or control of community air pollution. Adequate liaison will be maintained with Federal agencies to avoid duplication with other grant or research programs relating to air pollution.

## Contract Research Plans

The medical component of the community air pollution program is planning an extensive use

Of the cancer found, intraepithelial cancer occurs in younger age groups with a peak of incidence about age 33. The peak incidence of the invasive cancer is at age 52. This suggests that cancer of the cervix may exist for varying periods of time in a noninvasive form when it is completely curable.

## Mass Screening Potential

Experience indicates that the vaginal smear technique is an excellent procedure for finding cases of cancer. It will effectively screen out from the general population suspicious cases needing further study by biopsy, but a positive report on cytology examination is not a final diagnosis and biopsy examination must confirm the smear report before definitive therapy is carried out.

The many questions which remain concerning the control of uterine cancer can be answered only through additional investigations and research.

Research with the cytologic technique may answer questions that bear directly on the problem of controlling uterine cancer, questions such as:

- Does the carcinoma in situ lesion progress invariably to invasiveness?
- What is the true incidence and prevalence of the lesion?
- What is the earliest age at which the lesion occurs?
- Are there even earlier stages of the lesion?
- How many of these lesions regress spontaneously?
- What is the duration of the lesion before invasion?
- What is effective treatment for the lesion?
- Can improvement be made in the method of screening the smears?

Some of the research is already under way. One study relates to the development of an electronic device to mechanically sort out the large mass of negative smears from the positive and suspicious. Such a machine within the foreseeable future should greatly reduce the number of trained technicians required for a screening survey.

Answers to some of the other questions will be sought in 5 or 6 other pilot studies which we

expect to establish throughout the country, principally in connection with medical centers.

Meanwhile our experience has led us to conclude that vaginal aspiration and cytologic examination of the smear are practical procedures for discovering cervical cancer on a mass basis. The widespread application of this technique could potentially reduce cervical cancer mortality.

## Public Health Aspects Of Atomic Energy In Peacetime

**6** By Daniel Bergsma, M.D., M.P.H.  
New Jersey State Commissioner of  
Health and Vice President, Association  
of State and Territorial Health Officers

The emergence of the peacetime applications of nuclear energy is one of the beneficial concomitants of the development of nuclear weapons. Ionizing radiations are thus one more complexity that man has added to his environment. The consequent public health responsibility is to maintain all radiation exposure within the generally accepted limits without unnecessary interference with maximum utilization of radiation sources. Since its beginning in the early 1940's, the atomic energy industry has had a tremendous growth—first under the Manhattan Engineering District and then under its successor, the Atomic Energy Commission. The commission has capital assets of some \$12 to \$14 billion and an operating budget of almost \$2 billion a year. Private firms manufacturing equipment and devices needed in atomic energy work have investments and yearly sales running into many millions of dollars.

The amounts of radioactive materials dealt with have also increased enormously. A medium-size nuclear reactor, for example, may contain in the order of 100 million curies of radioactive materials. It is necessary to process

Possibly the fact that Papanicolaou was not a clinician but an anatomist working in a research field may have had some bearing on this lack of interest.

As a result of Papanicolaou's association in 1939 with Dr. Herbert F. Traut, and later with Dr. Andrew A. Marchetti, further investigations placed the use of vaginal smears in cancer diagnosis on a more solid basis. Papanicolaou and Marchetti introduced the endocervical and endometrial smear technique.

Following the close of World War II, reports by others began to appear in the literature recounting the use of this technique. Skepticism and doubt were expressed, particularly by pathologists, as to whether the technique could identify cancer cells. A portion of this resistance stemmed from the fact that by training and experience pathologists had learned to identify cancer on the basis of a section of tissue with a characteristic cell structure.

The numerous evaluations made of the accuracy and validity of the technique and the passage of time led to a change in the concepts of pathologists and an increasing acceptance of the technique as a diagnostic aid or screening technique for cancer.

Many clinical investigations have demonstrated that the Papanicolaou technique can indicate the probable existence of uterine cancer, particularly where the cervix is involved, even in the absence of significant signs or symptoms and without suggestive clinical evidence of the disease or gross findings.

Herein lies the greatest merit of the test. It permits the early recognition of incipient lesions such as carcinoma in situ, a microscopic lesion which is noninvasive and therefore 100 percent curable.

Here again there was reluctance to accept the findings, this time by the clinician. His resistance was based on the fact that for years uterine bleeding or spotting has been considered the cardinal sign of early cervical cancer. We now know that this is a sign of invasive cancer with ulceration rather than early carcinoma. Of necessity many studies and investigations had to be carried out to establish this fact.

As a consequence, the clinician's concept of early cervical cancer has gradually changed. In fact, at present it is believed that an appreciable

number of cervical cancers pass through the carcinoma in situ stage before invasion begins.

## The Memphis Study

The technique still faced the criticism that there would not be enough professional people to carry out the procedure. This situation led to the establishment in 1951 of a study in Memphis and Shelby County, Tenn., by the National Cancer Institute in cooperation with the University of Tennessee Medical School divisions of pathology and bacteriology and of obstetrics and gynecology, the Memphis and Shelby County Health Department, the Shelby County Medical Society, the Bluff City Medical Society, and the Shelby County unit of the American Cancer Society.

The purposes of the study were to determine the feasibility and practicality of vaginal cytology as a general population screening procedure; to determine age-specific incidence and prevalence rates for preinvasive and invasive cancer; and to determine the course and fate of carcinoma in situ.

Initially in this operation, nonprofessional persons, under the direction of a nurse, obtained the smears from clinic patients; a staff of cytology technicians screened the smears, sorting out the suspicious and positive smears from the negatives; pathologists made the final interpretation of the smears and carried out the tissue examination of biopsies resulting from the suspicious and positive smears.

Early in the program most of the smears came through clinics conducted throughout the area. With acceptance, an increasing number of smears came from private practitioners, and now more than half of the smears reviewed are from that source.

The results have been encouraging. The cytology findings of the first 70,000 women screened were suspicious or positive in 1,327 women or 1.9 percent. In this group 282 intraepithelial or carcinoma in situ cancers and 245 early invasive cancers were found. From the point of view of cancer control, it is especially significant that 88 percent of the intraepithelial and 29 percent of the invasive cancers were not suspected either by the physician or the patient.

in advance of the time the reactor begins operation so that the data will be representative of seasonal weather conditions, and it should be continued long enough after reactor startup to enable the selection of sampling locations that will provide the most useful data. Subsequent samples from these locations will give a good indication of whether or not the installation is contributing any increase of activity to the naturally existent levels.

Such sampling will normally be conducted by the operators of the installation. However, for its own knowledge the responsible State agency should conduct spot checks of its own.

## Disposal Problems

Under conditions of ultimate disposal, the wastes are far larger in volume, and activity levels are tremendously higher. These wastes will probably be due almost entirely to the chemical processing of reactor fuel elements. They may contain activity concentrations of several hundred curies per gallon. A further complication is introduced by the fact that a heat release of 2 or 3 British thermal units per hour per gallon of waste occurs as a result of the heat generated by the intense radiation. The higher the concentration of radioactivity, the higher the rate of heat release per unit volume and the greater the associated handling problems. Tanks containing highly concentrated wastes must be cooled to keep the liquid from boiling. Cooling of wastes adds substantially to the water demands of the installation.

Treatments which are effective in reducing or eliminating the toxic qualities of chemical wastes have no value whatsoever in dealing with radioactive wastes. The only method of disposing of radioactive wastes is by physical transfer from locations where they may be hazardous to areas where they will present no great threat. There is no chemical, physical, or biological means by which these materials can be made inactive or by which the rate of decay can be hastened. They can be made easier to handle by such methods as concentrating liquid volumes by evaporation or by making shipments in a number of small volumes to reduce shielding bulk.

At present, disposal of low-level wastes is by dilution to a safe level. This is obviously impractical with high-level wastes, since they would require dilutions of the order of 1 million gallons or more for each gallon of radioactive waste.

Several alternative solutions for high-level wastes have been suggested. Among these are pumping the wastes into permeable subsurface soils or into deep salt-bed formations. The theory behind these proposals is that the movement of ground water through such formations is so slow that a very large reduction in the amount of radioactivity would take place through natural decay before the activity could enter sources of potable water. Unfortunately, suitable geological formations are not located beneath the most convenient sites for processing plants.

Another proposal is to dump wastes in the oceans. The wastes would either be placed in suitable containers and allowed to sink to the bottom in about 1,000 fathoms of water, or they would be pumped to the bottom as liquids. Unfortunately, on the east coast of the United States the continental shelf extends many miles to sea, and our knowledge of deep ocean currents at present is not sufficient to enable accurate predictions of what the resultant dilution would be.

Because of the uncertainties involved in these proposed methods, the present solution is to store the wastes for years in underground tanks. In spite of precautions, it is always possible that such tanks may develop leaks and contaminate water supplies. Underground burial of solid wastes presents the same potential hazard. The problem of safe disposal of these wastes may well prove to be the limiting factor in the construction and operation of power reactors. If such wastes become free in the ground, they are beyond control. This problem may be one of the most critical facing us in public health.

A great deal of what has just been said relates specifically to nuclear reactors. A second large sphere of public health concern must be installations which are using radioisotopes for research and industrial purposes. Radioisotopes are presently available, not only from nuclear reactors, but also from particle accelerators.

chemically the fuel elements containing these vast quantities of radioactivity on a routine basis. In spite of this fact, the atomic energy industry has had a lost-time injury rate lower than any other major industry except communications. With the exception of a few accidents in connection with experimental work and the weapons testing program, no radiation injuries are known to have occurred.

Much of the Atomic Energy Commission's success in this respect is undoubtedly due to the enforcement of very conservative permissible exposure standards. The establishment of rigid control procedures at the inception of the atomic energy industry represents one of the few instances in which a major industry has set up a large program in health protection without the compulsion of a record of serious accidents.

## Two Types of Hazards

The field of atomic energy presents two types of health hazards due to ionizing radiations.

The radioactive material may become airborne or may contaminate food or water and so may enter the body via the lungs or by ingestion. In this case, such factors as the metabolism of the element concerned, its physical and biological half-lives, and the type of radiation it emits must be taken into account in determining permissible body burdens. An element that tends to concentrate in a particular organ, as does iodine in the thyroid, will produce a different pattern of injury from an element that is non-specific, such as carbon or sodium.

The gamma rays and the beta rays of radioactive material constitute an external radiation hazard. Beta rays are high-speed electrons which can cause a burn similar to a thermal burn in the skin but which do not affect the deeper layers of tissue. Gamma rays are identical with X-rays in their action but have somewhat higher energies than the common diagnostic X-ray. They are highly penetrating radiations and tend to expose the entire body, or major parts of it, more or less uniformly. The radiosensitivity of tissues and the relative efficiency of various radiations in causing biological damage must be considered in setting permissible exposure limits.

Public health problems can arise under conditions of use of radioactive materials and under conditions of their ultimate disposal. In the first instance, exposure may result from external sources of radiation or from ingested or inhaled contaminants. Depending on the method of disposal, this may also be true of the second instance. However, a significant difference exists in that under conditions of use the material is presumably under the control of the user, whereas under conditions of ultimate disposal the material has passed beyond, or is only partially under, the user's control.

## Problems of Use

One of the chief ways in which a public health problem may arise under conditions of use is the accidental release to the atmosphere or to the local liquid disposal system of radioactive materials. The release of radioactive material into the air or the disposal system is allowable provided the amount does not exceed permissible limits established by the Atomic Energy Commission. Small quantities are generally disposed of by sufficient dilution to keep resultant radiation levels below permissible limits. However, there is always the chance that malfunctioning of equipment or error on the part of personnel will allow the release of much larger quantities. In an effort to avoid this possibility, monitoring devices are commonly used in the effluent stream.

There is also the possibility of malfunctioning of the monitoring devices, and, in any event, the actual amount of dilution taking place remains a question. Therefore, it is necessary to measure radioactivity levels of air and water in downwind or downstream locations.

Since there may be appreciable variation in background, or natural, radioactivity from area to area, it is desirable that information on these levels be collected for various sections of a State. Where there is a major atomic energy installation, such as a nuclear reactor, it is sound practice to make a rather extensive investigation of the natural activity in the surrounding region, including soil and vegetation as well as air and water. The collection of data on background radiation should be started well

# The Current Status Of Hospital Survey And Construction Programs

7

By John W. Cronin, M.D.  
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and Medical Facilities,  
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Substantial progress has been made since the Hospital Survey and Construction Program was authorized in 1946. At that time the national bed deficit was in excess of 900,000. We now have 260,000 more acceptable hospital beds: 88,000 were constructed and put in operation through the Hospital Survey and Construction (Hill-Burton) Program.

The net gain since 1946 is much less than the total volume. In fact, it is only 70,000 beds, or less than 8 percent of the present estimated needs. This is influenced by the mounting obsolescence—physical and functional—and annual population increase. We have 73 percent of the general beds but only 56 percent of mental beds and 14 percent of chronic beds needed.

About one-third of all present hospital construction is through the Hill-Burton program. There are regional differences in volume of construction, which varies according to the average income of the area. Hill-Burton projects account for nearly all the construction undertaken in the lowest income areas but constitute only one-fifth of that in the wealthiest areas. This follows the basic intent to provide maximum aid to low-income States.

Some of the specific gains from the program include 2,600 approved projects which will provide 121,000 beds, and 1,900 completed projects which have provided 88,000 beds. In addition, 550 health centers, many related health facilities, and State health laboratories have been aided in their construction phases.

Progress in acquiring facilities in local areas may be measured by comparing 1946 figures, showing that 10 million people in 600 general

hospital service areas did not have access to acceptable hospital beds, with the current figures of 175 areas and 3 million people. However, there remain 336 other hospital service areas in which less than 50 percent of the total bed need has been met for a population of 23 million.

Specific illustration can be cited. In Alabama, the number of counties without acceptable general hospital beds has been reduced from 33 to 2, although 25 counties still have less than 50 percent of the need met.

Other benefits from the Hill-Burton program include assistance to teaching hospitals approved for intern and residency training, new teaching hospital facilities at university medical centers, improved design of hospital and related health facilities, new and better hospital licensure laws, minimum standards of hospital operation and maintenance established in all States, increased attention to related health facilities, and the development of an orderly system of planning for and providing hospitals and related facilities.

Six hundred communities now have hospitals where none existed previously. The nearly 800 new hospitals built in towns of less than 5,000 may serve well as evacuation destinations for critical areas in times of national catastrophe.

## The 1954 Amendments

The Medical Facilities Survey and Construction Act of 1954, amending the Hospital Survey and Construction Act, provides an inducement for the construction of facilities urgently needed for patients suffering from chronic illness and impairments as well as an inducement to the development of diagnostic and treatment centers and rehabilitation facilities.

Federal allotments to the States were earmarked for these specific types of facilities. The act obligates the States to make a survey of need. The appropriation is available through June 30, 1957.

Following the development of the Federal regulations and their promulgation in January 1955, the States began surveys relating to the new program, and by November 32 States



## AEC Control

Under the Atomic Energy Act of 1954, the distribution of all special nuclear material, source material, and byproduct material is controlled by the Atomic Energy Commission. By definition, special nuclear material refers to plutonium or uranium enriched in the isotope 233 or in the isotope 235. Source material is defined as natural uranium or thorium. Byproduct material includes all radioactive materials produced in the uranium by the process of nuclear fission and all substances made radioactive by exposure to the radiations resulting from the operation of a nuclear reactor.

Concerning control of byproduct materials, the material of interest in this discussion, the Atomic Energy Act of 1954 also states that "no person may transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, own, possess, import, or export any byproduct material," except under a license issued by the AEC. The act further states: "The Commission shall not permit the distribution of any byproduct material to any licensee, and shall recall or order the recall of any distributed material from any licensee, who is not equipped to observe or who fails to observe such safety standards to protect health as may be established by the Commission or who uses such material in violation of law or regulation of the Commission or in a manner other than as disclosed in the application therefor or approved by the Commission."

The necessity of obtaining a license before purchasing radioactive materials from the AEC or its licensees has been extended by the commission to cover radioactive materials produced in particle accelerators, providing these machines were built fully or in part with Federal funds. (Particle accelerators are important because in them it is possible to produce radioisotopes which cannot be formed in a nuclear reactor.) If an accelerator is built with private funds, however, the AEC has no authority over the isotopes so produced, nor has it any say in controlling radiation levels around the accelerators while they are in operation. The Nuclear Science and Engineering Corporation recently announced the inauguration of the first private program for the production and supply of cyclotron-produced isotopes (a cyclotron is one

type of particle accelerator). Procurement of these materials from this firm will not require AEC licensing or approval. Of course, interstate shipments of these materials will have to meet regulations governing the transportation of radioactive substances.

## State Responsibilities

The Atomic Energy Act in no way interferes with the power of the States to promulgate necessary or desirable rules and regulations. Since there is now at least one source of radioisotopes not subject to AEC control, and since such sources of radiation as X-ray machines and radium salts never have come under commission control, it may be that rules and regulations will have to be set up. When and if this is done, every effort should be made to maintain conformity with the recommendations of the National Committee on Radiation Protection and the requirements of the Atomic Energy Commission in order to avoid the chaotic situation that would result from 48 sets of incompatible regulations.

The Atomic Energy Commission, by virtue of its years of experience and the tremendous amount of research it conducts, is far better equipped than the individual States to formulate standards for maximum permissible concentrations in air and water, and for maximum permissible exposures to external radiation. But the State agencies can better carry on the actual regulatory and inspection functions. The commission performs these functions at present only because, having been directed to encourage the peacetime development of atomic energy, it felt it mandatory to safeguard the public health in the process. It is highly probable that the commission will be willing to relinquish much of this responsibility whenever a State agency demonstrates its readiness and ability to accept it.

The logical development of the regulation of isotope users would be the emergence of a relationship between State and local agencies and the Atomic Energy Commission parallel to that between the State and local health agencies and the Public Health Service. Where particular situations arise requiring specialized knowledge or facilities, the Atomic Energy Commission is available for consultation and assistance.

ourselves. We shall have to plan carefully: How much? how long? and how fast?

The basic program requirements for hospital and medical facilities have been affected by significant changes in the levels of hospital utilization and by reduction in the length of stay resulting from improvement in treatment and new medical discoveries. We shall need to plan wisely in relation to changes resulting from improvements and discoveries.

Fortunately, the 84th Congress has made available hospital research grant funds. These present opportunities to solve a host of hospital and related health problems through common effort. I would say that nothing is more needed than research on what is good care and what quantity of it is needed.

## Food and Drug Projects Of Interest to State Health Officers

8 By Jack M. Curtis, Ph.D.  
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Many programs of the Food and Drug Administration follow lines that are identical with the interests of State health officers. My purpose is to outline some of these programs as a means of directing attention to areas of mutual interest. This may help State health officers to exploit the resources of the Food and Drug Administration in their work of protecting public health.

### Protection Against Poisoning

One of the primary concerns of the Food and Drug Administration has been protection against poisoning—the acute, obvious poisonings contemplated by the Caustic Poisons Act as well as the chronic, subtle poisonings that may arise through the inclusion of chemicals in foods.

A growing concern over the public health hazards of numerous industrial and household chemicals is reflected by the activity of many national health organizations. The increasing number of the various household products containing hazardous chemicals makes it difficult for the family physician to keep abreast of the toxic substances and to recognize them by trade name.

The American Academy of Pediatrics, local health officers, the Food and Drug Administration, and the Public Health Service are working toward the formation in many large cities of poison centers that will accumulate data concerning the poisons that most frequently cause disastrous results. The centers will be ready on a 24-hour basis to advise physicians as to the type of antidoting that is appropriate.

In conjunction with the American Association of Medical Record Librarians, the Food and Drug Administration is studying methods whereby pilot studies can be set up in hospitals for the purpose of reporting untoward effects caused by therapeutic agents.

All of this information will help in pinpointing the toxic substances that are most important, in recommending more informative labeling, and in producing the basic data necessary to support any modification of existing laws.

We are also interested in the type of poisoning—to use the word in its broadest sense—which is caused by the misuse of potent drugs, particularly barbiturates and amphetamines. The problem is what can we do about the excessive use of barbiturates, resulting in suicides, accidental deaths, moral degeneration, or about the chronic use of excessive amounts.

It is illegal to sell these potent drugs except as directed by the prescription of a licensed practitioner. Only a very small number of pharmacists dispense the drugs indiscriminately. A still smaller number of physicians contribute to their pernicious misuse. But distribution outside licensed drug channels is increasing. In terms of the number of doses, the outlet by these various sources is tremendous.

The Food and Drug Administration investigates the illegal actions of druggists or physicians only on information from physicians, local police departments, health officers, or the

have had their plans approved for hospitals and 25 States for medical facilities.

The 1954 legislation is designed to emphasize the planning and construction of hospital-related medical facilities. Despite the increase in general hospital beds, people suffering from prolonged illness still had difficulty in obtaining care in facilities adequate to meet their needs and within their ability to pay. The need for less expensive facilities is, of course, only an indication of increasing requirement for such facilities. The demand stems from the aging of our population and its consequences in terms of increases in chronic diseases.

## Present Developments

The 25 State plans for medical facilities reflect an interest on the part of the States in coordinating hospitals and medical facilities. Certain categories which represent services rather than definable units, such as a hospital or nursing home, present problems, which will ultimately be solved as experience is gained.

For the most part, diagnostic and treatment centers are being planned in relation to general hospital service areas.

It is evident that a significant amount of services to ambulatory patients is being provided in hospitals, clinics, and public health centers, particularly the specialized clinics for psychiatric, cancer, heart, dental, and tuberculous patients. In an effort to bring basic general hospital services to the patient in his own community, most of the State plans provide for diagnosis and treatment centers initially in general hospitals or as an expansion of the outpatient departments.

The more specialized services are being planned in centers where there are large general hospitals and a concentration of population. The States are still groping for the solution in communities too small to support a general hospital. Only a few States are making provisions for free-standing diagnostic and treatment centers in such communities. With few exceptions, the State planning agencies recognize the tentative nature of the planning for diagnostic and treatment centers. They propose with experience to refine this aspect of their program in subsequent annual revisions.

Because a specific unit can be defined, the nursing home category seems to present less of a problem. Nevertheless some problems have appeared.

In most States the nursing home operators have felt that licensing by the State is evidence of meeting the required standards. The problem of interpreting what is meant by skilled nursing care is still with us. Planning for nursing homes, like that for diagnostic and treatment centers, is taking place in relation to the general hospital service area. Some criticism has developed with respect to the range of the bed ratio adopted for nursing homes. The majority of State plans use 3 beds per 1,000 population, but some groups believe this ratio is unrealistically high.

The problems with respect to chronic disease hospitals have not been as difficult because the States have had some experience. In some State plans, facilities previously designated as chronic disease hospitals are now shown as nursing homes. There is evidence of increasing development of means of distinguishing between chronic disease hospitals and nursing homes and of defining the services in each. Planning in this category is primarily centered on development of services for the chronically ill in large general hospitals.

With respect to rehabilitation facilities, the inventories fail to reflect the total rehabilitation resources within the States. Often occupational therapy and physiotherapy in hospital clinics are not identified.

Rehabilitation facilities for the most part are being programed at medical schools and medical centers. The majority of State plans, however, allocate all the facilities permitted under the ratios in the Federal regulations for this category. This may not be realistic. It would seem that comprehensive rehabilitation facilities as programed at universities and medical centers would be the more reasonable solution since, in our present state of knowledge, it is important to train rehabilitation workers.

## Need for Wise Planning

We need to develop understanding about these new programs—in the States as well as among

should be aware of the apparent trend of increasing amounts of antibiotics in milk.

The use of antibiotics as preservatives for food products is being investigated, for this is a field of development that may well bear careful watching.

Suggestions have been made that antibiotics be used as a spray on vegetables to inhibit rot after harvest, that chickens, after having been picked and cleaned, should be soaked in solutions containing an antibiotic to preserve them from spoilage while in transit and storage, and that antibiotics should be incorporated in the ice which is used to ice shrimp on their way to the market. None of these suggestions has been supported by sufficient experimental evidence to show that the antibiotic is not present in the food when it is consumed.

The growing practice of treating farm animals with hormones, particularly diethylstilbestrol, is justified by the economic advantage to be derived from improved quality or increased rate of growth and increased efficiency of feed utilization. Stilbestrol may be administered either in pellet form, implanted subcutaneously as is ordinarily done in chickens, or incorporated in the food as it is usually administered to cattle.

In chickens the drug causes a redistribution of fat, producing a plump, well-rounded carcass, easily and cleanly defeathered and of high quality. The effect on growth is slight. In cattle, on the other hand, the effect on growth is quite pronounced. Increases of growth of about 20 percent have been reported, along with a decreased feed consumption of about 15 percent. Usually, the carcass quality is about one grade lower.

The mechanism by which these changes take place is not clear. There is evidence that stilbestrol, whether it be fed or administered in pellet form, increases nitrogen retention in cattle. Furthermore, hypertrophy of the liver, of the adrenal glands, and of the pituitary without specific cellular changes has been reported. These observations seem to indicate a change in the endocrine gland metabolism, but exactly how these changes produce the increasing growth rate and increase in efficiency of food utilization is not clear.

The Food and Drug Administration has re-

quired the manufacturers of stilbestrol-containing feed supplements for cattle to submit extensive evidence that no added estrogen is in the edible portions of steers which have been fed these supplements. When this work was repeated in the laboratories of the Food and Drug Administration, it was shown that meat from steers fed 10 milligrams of stilbestrol a day contained not more than 0.6 parts per billion estrogenic activity when ready for market.

Therefore, it may be stated with considerable confidence that stilbestrol fed to steers under the conditions outlined by manufacturers of feed supplements will constitute no hazard as an additive to food products derived from animals thus fed.

Another problem concerns feeds prepared for small laboratory animals when the feeds have been run through mixers immediately following stilbestrol-containing feeds for steers. The result has been an accidental contamination of the small animal feeds with stilbestrol, which, in some cases, has quite serious effects upon the reproductive capacity of small animal colonies. Also, the results of hormonal assays would be erroneous if the experimental animals received this contaminated food.

The exact method of controlling such contamination and preventing its occurrence is under study by the Food and Drug Administration.

## Pesticidal Residues

The basic philosophy of control of pesticidal residues was changed somewhat by the passage of the pesticide chemicals amendment in 1954. Under this law, after the Secretary of Agriculture has certified that a pesticide is useful, application may be made to the Food and Drug Administration to establish tolerances or exemptions for the chemical, supported by data to establish that these tolerances are safe to the consumer. The type of data required is of interest.

The acute toxicity of the chemical is of value in appraising the hazards to those who handle or apply it.

The biochemistry of the compound including data on its absorption, excretion, storage, and metabolism is essential in evaluating the magni-

relatives of individuals that misuse drugs. Top priority is given to reports of the illicit distribution of barbiturates.

This type of investigation is a profitable opportunity for cooperation between State health officers and the Administration. To the extent that it is feasible under State laws, we are anxious to coordinate our activities with those of the States so that the consumer can be effectively protected.

## Regulating Medical Quackery

Our efforts to control medical quackery continue to be very difficult. Since the Food and Drug Act does not regulate the practice of medicine, our approach toward the control of medical quackery must be directed at the drugs or devices used in the treatment of disease. Our activity is necessarily limited to situations involving interstate shipment of drugs. The adequate control of medical quacks seems to be basically a State responsibility.

At the trial of the case against the Hoxsey Cancer Clinic in Texas, which culminated in the issuance of an injunction in October 1953, it was testified that more than 6,000 patients had come to the clinic in a 2-year period. The injunction prohibited the interstate shipment of the various drugs used in Hoxsey's supposed treatment of cancer.

More recently, a Hoxsey cancer treatment center in Pennsylvania has opened, with the backing of influential local people. Action has been taken against the center, but legal delays have slowed up enforcement results.

On November 7, 1955, the Texas State Board of Medical Examiners revoked the licenses of 6 osteopaths and 1 medical doctor associated with the Hoxsey clinic, finding them guilty of "unprofessional" and "dishonorable" conduct. Their attorney has announced he will appeal.

If the States could "nip in the bud" the promoters of fake drugs and devices, they would be serving their citizens well and at the same time they might prevent the growth of a formidable fraud.

The Electronic Medical Foundation of San Francisco consented to an injunction in March 1954 against the shipping of 13 different types

of electronic devices used for the diagnosis and treatment of serious diseases.

Among the devices was one represented as a "tuning apparatus" by which it was supposedly possible to distinguish the alleged characteristic radio frequencies associated with different diseases. Called a Radioscope, the apparatus had dials, lights, wires, and a slot in which could be placed a specimen carrier of filter paper bearing dried blood of a patient. Investigation showed that this blood diagnostic service was incapable of distinguishing the blood of animals or birds from that of man or that of the living from the dead. Diagnostic "readings" from this machine were sent to local practitioners with instructions for treatment by other machines also supplied by the foundation. More than 5,000 of the treatment machines had been distributed at the time of the injunction decree.

## Antibiotics and Food

The administration of antibiotics and hormones to animals, which later will be used as food for man, is a special segment of the problem of chemical additives in food. The feeding of low levels of antibiotics to animals has not resulted in the deposition of any appreciable residue of antibiotics in the tissues of these animals, but the use of larger quantities of antibiotics for the treatment of disease, such as the treatment of mastitis in cattle by intramammary infusion, has caused concern.

This problem was recognized first in the cheese industry when starter colonies would not grow in milk collected from animals so treated.

The Food and Drug Administration found positive results of penicillin in 3.2 percent of 94 samples of milk collected throughout the United States in 1954. In 1955, 11.6 percent of 474 samples of milk from all parts of the country were found to be positive for penicillin. The actual amounts were quite small and they were regarded by authorities on antibiotics as unlikely to change oral or intestinal flora or to provoke sensitization in a nonsensitive consumer.

Although the evidence is not adequate for definite conclusions, State dairy sanitarians

# Willamette Valley Chest X-ray Survey

By GORDON C. EDWARDS, M.D., M.P.H.

THE WILLAMETTE VALLEY chest X-ray survey in 1951 was the first attempt in the United States at conducting a large-scale rapid-tempo communitywide chest X-ray survey in a relatively sparsely populated, predominantly rural area. It was the 16th large-scale survey undertaken through use of the survey equipment and personnel available by loan from the Public Health Service.

This report is intended to be an objective appraisal of the findings of the Willamette Valley chest X-ray survey, based on a study of the final postsurvey diagnoses supplied by the private physicians examining survey cases referred for followup because of suspect chest X-ray findings.

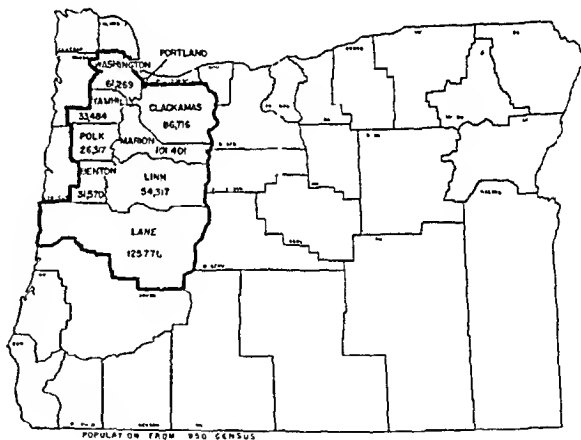
A number of rapid-tempo mass chest X-ray surveys have been reported in the past, including such large-scale operations as Los Angeles, Boston, and Cleveland. A similar report, in limited publication, was made shortly after conclusion of the Willamette Valley survey by the Report Committee of the Willamette Valley Chest X-ray Survey, Inc. Survey findings in that report were based on a statistical analysis of readings of 70-mm. and 14" x 17" retake screening X-rays taken during the survey, but it lacked the essential element of clinical appraisal for definitive diagnosis. The present report includes this all-important feature.

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The survey area included eight Oregon Willamette Valley counties: Benton, Clackamas, Lane, Linn, Marion, Polk, Washington, and Yamhill. Excluded, however, were Multnomah County and its county seat, the city of Portland. The eight counties chosen cover an area of about 13,000 square miles, larger by far than many States, and contained a population



of about 520,850 persons, almost wholly white and largely American born. The region lies between the coast range on the west, the Cascade Mountains on the east, and the foothills of these two mountain ranges on the south, and is traversed through its length by the Willamette River, emptying into the Columbia River which forms the valley's northern border. It has been called the garden of Oregon and was the lode-stone that drew and still draws thousands westward to its fertile soil.

Southernmost in the valley and largest of the

tude of the hazards to the consumer when residues of the chemical remain on food. For example, it has been found that during the usual process of detoxification of heptachlor, an epoxy derivative that was produced was three times as toxic to animals as the original pesticide.

Next, the chronic toxicity of the chemical is required. This involves a 2-year feeding study in rats and, if necessary, rather prolonged studies in another species of animal, usually the dog.

Finally, there is a pathological examination of the organs of these experimental animals in order to locate the site and to determine the extent of injury produced.

All these data are then considered together to arrive at a tolerance that will protect the sick, the healthy, the young, the old. This tolerance includes a safety factor that is designed to permit a maximum intake of the chemical from all possible sources that is no greater than one one-hundredth of the largest dose that is known to produce no injury to the experimental animal.

The various tolerances as they are determined are published in the *Federal Register*, but to provide this information in a more convenient form the Administration provides a looseleaf service entitled "Summary of Tolerances and Exemptions for Residues of Pesticide Chemicals."

### Diseased Poultry Inspection

The sanitation of poultry dressing plants and the antemortem and postmortem inspection of poultry to eliminate diseased birds from channels of commerce are problems that have been considered before by the Association of State and Territorial Health Officers.

An advisory panel of outstanding poultry pathologists and research workers has met with members of the Food and Drug Administration and the Public Health Service to make recommendations regarding inspection procedures and the disposition of diseased poultry. As a result, there is in preparation a manual of inspection procedures.

### Civil Defense Activities

The food and drug program relating to civil defense has been developed along educational and technical lines. Courses of instruction in methods of inspection when contamination with radioactivity is suspected are now being given throughout the country and will be continued throughout fiscal 1956. Each of our 16 districts has been supplied with the necessary items of equipment to measure radioactive contamination and has been instructed in their use.

Representative samples of both food and drugs have been exposed to atomic blast to determine its effect on them. In only two drug products, insulin and vitamin B<sub>12</sub>, did the potency deteriorate. Glass containers were discolored and, if close enough to the blast, became radioactive. Since studies of the food exposed more recently have not been completed, about all that can be said is that the foods have an off taste. When radioactivity was induced it seemed to be related to the phosphorus concentration in the food. Further feeding studies are under way.

. . .

*NOTE: Since this paper was delivered, evidence has been submitted to prove the absence of a chlortetracycline residue in cooked but not in fresh poultry which had been killed in water containing 10 p.p.m. of the antibiotic.*



in the report, "Viewing the Valley," published by the Willamette Valley Chest X-ray, Inc., in 1952. The Public Health Service supplied 18 mobile X-ray units, film, processing materials and operating personnel, physicians to read films, clerical staff for record and statistical services, and consultation. In addition, two X-ray units of the Oregon State Board of Health, with operating personnel, participated in the survey, and many professional and lay

individuals at both State and local levels participated on a full-time or part-time basis.

Each of the eight participating counties was separately and independently organized, each with its own county executive committee and chairman. The medical society, health department, and tuberculosis and health association in each county served as sponsoring agencies, inviting the active participation and help of all other groups, agencies, and individual citizens

**Table 2. Number and percent of females X-rayed, by age and county,<sup>1</sup> Willamette Valley chest X-ray survey, 1951**

[Based on 10-percent sample of 70-mm. registrations]

County	Under 15	15-24	25-34	35-44	45-54	55-64	65+	Unknown age	Total <sup>2</sup>
<i>Benton</i>									
Number.....	270	2,060	1,420	1,260	1,020	760	520	30	7,340
Percent.....	7.2	59.8	58.8	74.8	73.6	64.8	46.8	-----	49.0
<i>Clackamas</i>									
Number.....	650	3,180	3,330	3,000	2,140	1,480	1,130	160	15,070
Percent.....	5.5	38.9	52.2	46.8	42.6	38.1	30.8	-----	35.3
<i>Lane</i>									
Number.....	890	7,260	7,200	6,460	4,440	3,110	1,780	150	31,290
Percent.....	5.2	72.5	70.5	75.3	70.7	66.4	43.0	-----	51.2
<i>Linn</i>									
Number.....	150	3,020	3,260	2,460	1,620	1,170	810	40	12,530
Percent.....	1.8	80.0	76.2	66.2	64.5	59.4	42.4	-----	47.3
<i>Marion</i>									
Number.....	810	6,260	5,090	5,740	4,230	3,200	2,200	140	27,670
Percent.....	6.4	85.5	70.8	81.6	71.4	63.8	43.1	-----	55.1
<i>Polk</i>									
Number.....	170	1,690	1,270	1,100	990	670	500	10	6,400
Percent.....	4.4	85.4	65.8	63.9	74.4	63.2	50.0	-----	49.8
<i>Washington</i>									
Number.....	490	2,800	2,750	2,640	1,880	1,260	710	30	12,560
Percent.....	5.9	71.9	61.2	59.2	53.0	45.2	27.8	-----	41.8
<i>Yamhill</i>									
Number.....	60	2,180	1,440	1,750	1,290	1,100	970	50	8,840
Percent.....	1.3	88.7	63.3	81.9	71.2	68.6	58.5	-----	53.5
<i>Valley</i>									
Number.....	3,490	28,450	25,760	24,410	17,610	12,750	8,620	610	121,700
Percent.....	5.0	74.3	65.7	68.3	63.3	57.5	40.8	-----	47.8

<sup>1</sup> Estimated number X-rayed varies slightly from totals in tables 3 and 5, which are enumerated by the survey units. Discrepancies are mainly due to loss of approximately 850 registration cards in Clackamas County.

<sup>2</sup> These percentages are decreased by inclusion of the under age 15 group, who were X-rayed only on specific request of, and referral from, a physician.



survey counties in area and population is Lane County with its city of Eugene, home of the University of Oregon. Lying north of Lane are Linn, Benton, Marion, Polk, Yamhill, Washington, and Clackamas Counties, the latter two extending to the Portland metropolitan area. Corvallis, county seat of Benton County, is the site of Oregon State College, while the Oregon College of Education is located at Monmouth in Polk County. Salem,

the State capital, is also the county seat of Marion County. The outline map of Oregon shows the survey area and the populations of the counties involved.

### The Operation

The actual survey operation time was between July 17 and October 24, 1951. Details on planning and operation of the survey were given

**Table 1. Number and percent of males X-rayed, by age and county,<sup>1</sup> Willamette Valley chest X-ray survey, 1951**

[Based on 10-percent sample of 70-mm. film registrations]

County	Under 15	15-24	25-34	35-44	45-54	55-64	65+	Unknown age	Total <sup>2</sup>
<i>Benton</i>									
Number.....	250	2,440	1,550	1,070	930	480	470	20	7,210
Percent.....	6.4	51.8	50.6	61.7	68.1	43.0	48.5	-----	43.5
<i>Clackamas</i>									
Number.....	580	2,790	2,290	2,920	2,170	1,520	1,520	100	13,890
Percent.....	4.6	53.8	37.9	45.7	40.4	34.4	37.1	-----	31.5
<i>Lane</i>									
Number.....	720	6,100	6,390	6,210	4,560	3,070	1,890	220	29,160
Percent.....	3.9	62.3	60.3	66.1	64.2	60.5	43.5	-----	45.1
<i>Linn</i>									
Number.....	180	2,450	2,880	2,470	1,780	1,210	830	20	11,820
Percent.....	2.1	68.2	68.0	60.5	61.1	53.4	41.0	-----	42.5
<i>Marion</i>									
Number.....	710	5,350	5,450	5,010	3,910	2,860	2,190	150	25,630
Percent.....	5.3	73.2	73.5	70.6	65.3	57.0	45.2	-----	50.1
<i>Polk</i>									
Number.....	160	1,500	1,500	1,180	950	800	660	60	6,810
Percent.....	4.0	75.1	78.7	63.3	65.1	67.9	61.9	-----	50.5
<i>Washington</i>									
Number.....	440	2,410	2,310	2,330	1,530	1,200	1,200	120	11,540
Percent.....	5.0	61.5	52.5	52.9	40.7	38.5	41.3	-----	36.9
<i>Yamhill</i>									
Number.....	50	1,740	1,380	1,440	1,340	1,140	920	40	8,050
Percent.....	1.1	68.2	61.1	66.0	71.2	72.8	52.7	-----	47.6
<i>Valley</i>									
Number.....	3,090	24,780	23,750	22,630	17,170	12,280	9,680	730	114,110
Percent.....	4.1	63.9	59.5	60.9	57.5	51.7	44.0	-----	42.9

<sup>1</sup> Estimated number X-rayed varies slightly from totals in tables 3 and 5, which are enumerated by the survey units. Discrepancies are mainly due to loss of approximately 850 registration cards in Clackamas County.

<sup>2</sup> These percentages are decreased by inclusion of the under age 15 group, who were X-rayed only on specific request of, and referral from, a physician.

was checked. This sample served as a basis for studying the suspect cases reported through 14" x 17" film retakes and the diagnosed cases reported through epidemiological followup. General makeup of the participating survey group with respect to age and sex, by county, is shown in tables 1 and 2, and breakdown of the total valley population by age and sex is shown in table 7.

### Statistical Analysis

The 1950 census of the 8 valley counties showed a combined population, age 15 years and over, of 375,815. The total of 237,229 70-mm. films taken during the survey would indicate a coverage, ignoring duplications and nonresidents, of approximately 63 percent of those eligible (table 3).

A total of 7,415 small films were read as showing abnormalities. Of these 4,222 were suspect tuberculosis, 2,846 other chest pathology and 347 suspect cardiovascular disease. Twenty-two of the 7,415 were duplications, which left 7,393 individuals for recall to retake centers (table 3).

Seven hundred seven individuals of the 7,393 recalled did not respond. Small films of these persons were reviewed, and 206 were classified as not sufficiently significant to warrant further followup. One hundred seven, who were visitors to the area or had moved since X-ray, were referred to the health departments of their jurisdictions for followup, and 192 were referred to valley health departments. The remainder were found already under care, or referred to physicians or State institutions, or were deceased (table 4).

A total of 6,822 individuals returned for retakes, including 136 with unsatisfactory or negative 70-mm. films. Of these, 6,560 had confirmatory 14" x 17" films taken while 262 received cardiac interview only, with referral to their physician (table 3).

Out of 6,560 confirmatory 14" x 17" films taken, 11 were technically unsatisfactory and were referred for further followup. An additional 2,766 individuals were referred for further study on the basis of X-ray interpretation, 1,264 for tuberculosis and 514 for suspect tuberculosis. The remaining X-ray referrals were 988 for other chest diseases including 89 cardio-

Table 4. Referrals for followup, Willamette Valley chest X-ray survey, 1951

Referrals	Valley total	Benton	Claekamas	Lane	Linn	Marion	Polk	Washington	Yamhill
Individuals referred for followup-----	<sup>1</sup> 2,777	149	356	733	238	630	202	256	176
Tuberculosis-----	1,778	107	246	454	158	376	131	168	107
Total reinfection type-----	1,264	71	147	306	116	286	116	112	92
Minimal-----	840	50	99	198	81	195	73	71	59
Moderately advanced-----	348	18	40	86	29	75	35	31	30
Far advanced-----	39	2	5	7	3	8	6	6	2
Unclassified-----	37	1	3	15	3	8	2	4	1
Suspect tuberculosis-----	514	36	99	148	42	90	15	56	15
Cardiovascular-----	89	5	13	26	7	19	3	7	8
Other chest diseases-----	899	37	95	252	73	230	66	80	61
Technically unsatisfactory-----	11	0	2	1	0	5	2	1	0
Individuals not responding-----	<sup>2</sup> 707	20	100	115	59	133	22	49	35
Already under care for tuberculosis-----	13	0	4	5	0	4	0	0	0
Referred to physician-----	87	2	19	24	4	23	5	6	4
Referred to State health departments as suspect tuberculosis (visitor or moved)-----	107	0	2	5	3	4	1	1	1
Visitor, nontuberculosis, not referred-----	78	0	0	2	1	1	1	1	0
Deceased-----	10	0	5	0	0	2	2	1	0
Small film reclassified as not significant-----	206	7	40	43	24	39	5	22	14
No disposition, referred to health department-----	192	11	30	36	27	46	8	18	16
Referred to State institutions-----	14	0	0	0	0	14	0	0	0

<sup>1</sup> Includes 37 persons with residence outside the valley.

<sup>2</sup> Includes 174 persons with residence outside the valley.

Table 3. X-ray findings, Willamette Valley chest X-ray survey, 1951

Status	Valley total	Ben- ton	Clack- amas	Lane	Linn	Mar- ion	Polk	Wash- ington	Yam- hill
Total small films taken.....	237, 220	14, 608	29, 816	60, 525	24, 446	53, 519	13, 233	24, 126	16, 956
Estimated number persons eligible for X-ray.....	375, 815	23, 911	62, 253	90, 245	37, 279	75, 271	18, 494	44, 235	24, 127
Small films taken as percentage of eligible.....	63.1	61.1	47.9	67.1	65.6	71.1	71.6	54.5	70.3
Abnormal findings (70 mm.).....	<sup>1</sup> 7, 415	327	961	1, 723	737	1, 687	508	636	578
Suspect tuberculosis.....	<sup>2</sup> 4, 222	202	574	1, 010	393	923	278	345	331
Suspect other chest pathology.....	<sup>3</sup> 2, 846	112	353	630	316	662	199	265	224
Suspect cardiovascular disease.....	<sup>4</sup> 347	13	31	83	28	102	31	26	23
Duplications, represented in ab- normal total.....	22	0	1	6	1	3	4	3	4
Total individuals recalled.....	<sup>5</sup> 7, 393	327	960	1, 717	736	1, 684	504	633	574
Individuals responding.....	<sup>6</sup> 6, 686	307	860	1, 602	677	1, 551	482	584	539
Individuals not responding.....	<sup>7</sup> 707	20	100	115	59	133	22	49	35
Total individuals returning for retake.....	<sup>8</sup> 6, 822	307	866	1, 670	682	1, 576	506	589	541
Number with cardiac interview only (14" x 17" films).....	<sup>9</sup> 262	9	18	72	22	74	30	19	15
Total confirmatory films read.....	<sup>10</sup> 6, 560	298	818	1, 598	660	1, 502	476	570	526
Essentially negative.....	<sup>11</sup> 1, 986	76	298	467	195	439	151	169	163
Evidence of old healed disease in- cluding nontuberculosis.....	<sup>12</sup> 1, 797	73	191	398	227	433	123	145	187

Note: Footnoted figures include the following numbers of persons with residence outside the valley: <sup>1</sup> 258; <sup>2</sup> 166; <sup>3</sup> 85; <sup>4</sup> 7; <sup>5</sup> 258; <sup>6</sup> 81; <sup>7</sup> 174; <sup>8</sup> 85; <sup>9</sup> 3; <sup>10</sup> 82; <sup>11</sup> 28; <sup>12</sup> 17.

\* Includes 136 individuals with unsatisfactory or negative 70-mm. films who came in for a 14" x 17" film.

in the community. Valleywide coordination and cooperation was obtained by setting up the Willamette Valley Chest X-ray Survey, Inc., with headquarters in Salem and a board of directors consisting of the chairmen of the principal valleywide committees and the general chairman from each participating county, plus State representation from the Oregon State Board of Health, Tuberculosis and Health Association, Heart Association, and Cancer Society. A survey director for the entire valley was appointed to direct and coordinate operations.

### The Policy

Overall survey policy was established by the executive committee and board of directors of Willamette Valley Chest X-ray Survey, Inc. Professional policy regarding criteria for interpretation of X-ray films, criteria for recall for 14" x 17" film retakes, interview procedures in retake centers, and referral methods were developed by a Professional Policies Committee, with representation from the county medical societies and health departments involved and chaired by a member of the Tuberculosis Committee of the Oregon State Medical Society.

All suspect chest pathologies except cardiovascular were recalled for 14" x 17" film recheck. All suspects on 14" x 17" film retakes were referred to their private physicians for further study and definitive diagnosis. Epidemiological followup was a responsibility of the local health department in the area of residence of the suspect. Chest pathology other than tuberculosis was followed only to the point of establishment of medical consultation although all physicians of referral were queried through a specially developed epidemiological report form to obtain final diagnosis. Diagnoses other than tuberculosis were supplied by physicians on a purely cooperative basis since the majority of conditions involved (such as neoplasm and heart disease) are not reportable in Oregon.

### The Population Involved

The aim of the survey was to obtain a chest X-ray of every person in the valley 15 years of age and over. Children under age 15 were X-rayed only on specific request and referral from a physician.

To determine the makeup of the population X-rayed, every tenth registration card of all individuals registered for 70-mm. film X-rays

Table 7. Population participation,<sup>1</sup> active tuberculosis cases, and neoplasm cases, by age and sex, Willamette Valley chest X-ray survey, 1951

Cases and rates	Total <sup>2</sup>	Under 15	15-24	25-34	35-44	45-54	55-64	65+	Unknown
Total population in survey communities.....	520,850	145,035	77,089	79,008	72,904	57,657	45,930	43,137	-----
Male.....	266,019	74,539	38,803	39,919	37,167	29,846	23,747	21,998	-----
Female.....	254,831	70,496	38,286	39,179	35,737	27,811	22,183	21,139	-----
Number participating in survey.....	235,810	6,580	53,230	49,510	47,040	34,780	25,030	18,300	1,340
Male.....	114,110	3,090	24,780	23,750	22,630	17,170	12,280	9,680	730
Female.....	121,700	3,490	28,450	25,760	24,410	17,610	12,750	8,620	610
Percent participating.....	45.3	4.5	69.1	62.6	64.5	60.3	54.5	42.4	-----
Male.....	42.9	4.1	63.9	59.5	60.9	57.5	51.7	44.0	-----
Female.....	47.8	5.0	74.3	65.7	68.3	63.3	57.5	40.8	-----
Number of active tuberculosis cases found.....	131	0	8	29	23	17	24	30	0
Male.....	84	0	3	13	14	12	16	26	0
Female.....	47	0	5	16	9	5	8	4	0
Number of active tuberculosis cases per 1,000 participants.....	.56	0	.15	.59	.49	.49	.96	1.64	0
Male.....	.74	0	.12	.55	.62	.70	1.30	2.69	0
Female.....	.39	0	.18	.62	.37	.28	.63	.46	0
Number of neoplasm cases found.....	125	1	3	7	12	27	24	49	2
Male.....	71	0	1	6	5	17	16	24	2
Female.....	54	1	2	1	7	10	8	25	0
Number of neoplasm cases per 1,000 participants.....	.53	.15	.06	.14	.26	.78	.96	2.68	1.49
Male.....	.62	0	.04	.25	.22	.99	1.30	2.48	2.7
Female.....	.44	.29	.07	.04	.29	.57	.63	2.90	0

<sup>1</sup> These data are based on a 10-percent sample of original report cards. Estimated numbers X-rayed vary slightly from totals shown in tables 3 and 5, which are totals enumerated by the survey units. Discrepancies are mainly due to loss of approximately 850 registration cards in Clackamas County.

<sup>2</sup> Percentages are decreased by inclusion of the under age 15 group, who were X-rayed only on specific request of, and referral from, a physician.

vascular. Reported essentially negative were 1,986 (tables 3 and 4).

Of the 2,777 individuals referred for further study, a total of 2,234, or 80.4 percent, were followed to completion of diagnosis (table 5). The remaining 543 individuals were followed by field visit, mail query, and by contacting the physician named at time of X-ray, but for various reasons, such as moving out of area, non-cooperation, and death, final diagnosis was not obtained. Completion of followup to diagnosis varied from 73.2 percent in Marion County to 92.1 percent in Clackamas.

Final diagnosis on the above 2,234 individuals, as supplied by the attending physician, is shown by county in table 5. Diagnosis was accepted only on signed report of the attending physician and no case was tabulated as tuberculosis on the basis of X-ray interpretation or positive sputum findings, or both, without clin-

ical appraisal and report. An arbitrary cut-off date of 2 years postsurvey was adopted, and survey cases reported after this date were not credited to the survey. Only previously unreported active tuberculosis cases were credited to survey discovery.

On these bases there were 131 previously unknown active pulmonary tuberculosis cases reported and 125 neoplasms. One hundred twenty individuals, including 90 with activity undetermined at time of report and 30 arrested or inactive less than 2 years, were also reported and added to the tuberculosis followup register. In addition, 542 individuals were reported for other miscellaneous chest diseases and 26 for cardiovascular disease.

Table 5 shows by county the yield of newly discovered active tuberculosis cases and neoplasms per 1,000 70-mm. films taken. On the basis of 237,229 70-mm. films for the entire val-

**Table 5. Followup and final diagnosis and active tuberculosis and neoplasm cases per 1,000 70-mm. films, Willamette Valley chest X-ray survey, 1951**

Status and rate	Valley total	Benton	Clackamas	Lane	Linn	Marion	Polk	Washington	Yamhill
Followup and final diagnosis									
Referred for followup.....	12,777	149	356	733	238	630	202	256	176
Followup completed.....	2,234	131	328	564	206	461	166	231	147
Percent followup completed.....	80.4	87.9	92.1	76.9	86.6	73.2	82.2	90.2	83.5
Final diagnosis as:									
"Register" tuberculosis <sup>2</sup> .....	251	10	21	50	35	74	16	20	25
Inactive tuberculosis <sup>3</sup> .....	875	65	136	195	89	139	84	97	70
Neoplasm.....	125	6	20	19	13	38	10	12	7
Cardiovascular <sup>4</sup> .....	26	2	1	12	3	2	2	3	1
Other chest diseases.....	542	20	52	152	49	129	45	68	27
Negative.....	415	28	98	136	17	79	9	31	17
Active tuberculosis and neoplasms									
Number small films taken.....	237,229	14,608	29,816	60,525	24,446	53,519	13,233	24,126	16,956
Number active tuberculosis cases per 1,000 small films.....	0.55	0.34	0.60	0.55	0.57	0.47	0.68	0.50	0.88
Number neoplasms per 1,000 small films.....	.53	.41	.67	.31	.53	.71	.76	.50	.41

<sup>1</sup> Includes 37 persons with residence outside the valley.

<sup>2</sup> Cases requiring public health supervision. Includes (1) active; (2) arrested less than 2 years; (3) activity undetermined.

<sup>3</sup> Inactive or arrested 2 years or more.

<sup>4</sup> Bulk of cardiac suspects (70 mm.) not included.

**Table 6. Category of diagnoses after referral to physician, by age and sex, Willamette Valley chest X-ray survey, 1951**

Diagnosis	Total	Under 15	15-24	25-34	35-44	45-54	55-64	65+	Unknown
Negative.....	415	1	20	32	58	89	97	114	1
Male.....	216	1	10	14	30	47	49	65	0
Female.....	199	3	10	18	28	42	48	49	1
"Register" tuberculosis <sup>1</sup> .....	251	0	13	41	43	38	51	65	0
Male.....	156	0	5	18	29	25	30	49	0
Female.....	95	0	8	23	14	13	21	16	0
Inactive tuberculosis.....	875	3	20	81	134	171	210	255	1
Male.....	447	1	11	33	62	93	115	132	0
Female.....	428	2	9	48	72	78	95	123	1
Neoplasms.....	125	1	3	7	12	27	24	49	2
Male.....	71	0	1	6	5	17	16	24	2
Female.....	54	1	2	1	7	10	8	25	0
Cardiovascular.....	26	0	0	0	4	5	5	12	0
Male.....	16	0	0	0	2	1	5	8	0
Female.....	10	0	0	0	2	4	0	4	0
Other chest diseases.....	542	2	24	38	65	88	154	171	0
Male.....	256	1	11	21	34	39	70	80	0
Female.....	286	1	13	17	31	49	84	91	0
All diagnoses.....	2,234	10	80	199	316	418	541	666	4
Male.....	1,162	3	38	92	162	222	285	358	2
Female.....	1,072	7	42	107	154	196	256	308	2

<sup>1</sup> Cases requiring public health supervision. Includes: (1) active; (2) arrested less than 2 years; (3) activity undetermined.

Table 9. Year of last prior chest X-ray according to category of definitive diagnosis, Willamette Valley chest X-ray survey, 1951

Category of definitive diagnosis	Total patients	Within 1 year	1 to 2 years	2 to 3 years	3 to 5 years	5 years or more	Date unknown	No prior chest X-ray	Not stated
Tuberculosis.....	1, 126	29	104	187	193	269	23	268	53
Neoplasms.....	125	4	14	15	18	25	1	42	6
Other.....	568	12	37	89	90	139	6	167	28
Total.....	1, 819	45	155	291	301	433	30	477	87

the low overall participation in Clackamas County may largely nullify the comparative case-finding results in that county in view of the claim by some that the proportion of positive tuberculosis findings increase as coverage approximates 100 percent of eligibles. Further study of findings by age group and sex by county may prove of value.

The arbitrary 2-year diagnostic followup and report period, adopted to permit as full a completion of diagnostic study and completion of reporting as reasonably possible, doubtless does have a tendency to increase the ratio of moderately and far-advanced cases over minimal. Stage of disease of all survey cases at time of reporting is shown by county in table 8. Of the 131 reported active cases, approximately 24.5 percent were reported as minimal, and 64.1 percent as moderately advanced. Only 13 cases in all, or 9.9 percent, were reported as far advanced. In 1.5 percent the stage of disease was not indicated. These figures compare favorably with available Oregon data on routinely reported pulmonary cases for 1953, which show of 320 such cases only 15.3 percent were minimal, 36.6 percent moderately advanced, and 26.2 percent far advanced. In 21.9 percent, the stage was undetermined.

At the time of registration for miniature chest X-ray, a history was obtained of the length of time since previous chest X-ray. Among the tuberculosis cases diagnosed, almost

one-fourth had had no chest X-ray in 5 years, while an equal number had never had a prior chest X-ray. Among neoplasm cases, 20 percent had had no chest X-ray in 5 years, while one-third had never had prior chest X-rays. Exact figures according to diagnosis are shown in table 9. Considering all diagnoses together, almost exactly one-half the cases had no prior X-rays or had none within 5 years.

### Conclusion

Results of this survey definitely indicate the value of mass chest X-ray of apparently healthy people. The discovery of slightly more than one previously unknown active case of tuberculosis for every 2,000 participants would alone justify the survey without considering the cases of neoplasm and cardiovascular and other chest diseases revealed as an extra dividend. It is recognized that other procedures such as routine chest X-ray of hospital admissions will reveal higher numbers of cases per 1,000 chest films, but such surveys dealing with ill people are complementary and not a substitute for surveys of the apparently well. Cases discovered before symptoms force medical consultation are found in earlier stages of disease although many suspects screened by routine chest X-ray go a distressingly long time before final definitive diagnosis.

ley, 0.55 active tuberculosis cases and 0.53 neoplasms were found for each 1,000 small films. The 899 individuals referred on 70-mm. and 14" x 17" films for other chest diseases, and approximately 351 for cardiovascular disease, undoubtedly included many with previously undiagnosed conditions who benefited by further study, but no attempt is made to tabulate or break down for further study these cases reported.

As might be expected, significant differences were revealed for diagnosis of tuberculosis and neoplasms in individuals of various age groups and different sex. Variation was also found in occurrence rates in different counties. Break-down of physician diagnosis by age and sex is shown in table 6, while table 7 shows the find-

ings of active tuberculosis and neoplasms by 10-year age groups, and the number of cases per 1,000 small films taken of participants. cursory examination reveals that while the survey participation was poorest in the age group 65 and over the returns per 1,000 70-mm. films taken were highest in this group both in active tuberculosis cases and neoplasms found. This would seem to indicate a need for increased emphasis on the older age groups in future surveys.

Clackamas, Linn, Marion, and Yamhill Counties seemingly had the highest overall tuberculosis case yields. The relatively high rate per 1,000 miniature films may be particularly significant in Marion County in view of the low percentage of completed followup. Similarly,

Table 8. Tuberculosis cases by county and sex, according to stage and activity, Willamette Valley chest X-ray survey, 1951

Stage and activity	Valley total		Benton		Clackamas		Laurel		Linn		Marion		Polk		Washington		Yamhill	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Minimal:																		
Active	17	15	0	1	2	4	4	0	3	1	3	2	3	1	0	4	2	2
Activity undetermined	25	16	0	0	0	0	2	1	6	3	15	11	0	0	1	1	1	0
Arrested or inactive less than 2 years	10	4	0	0	1	0	3	1	2	1	0	1	2	0	0	0	2	1
Moderately advanced:																		
Active	56	28	2	2	8	1	18	6	4	5	10	8	4	1	4	2	6	3
Activity undetermined	16	11	3	0	0	1	0	1	2	2	5	4	2	0	3	1	1	2
Arrested or inactive less than 2 years	6	5	0	0	1	0	1	1	0	1	1	2	1	0	0	0	2	1
Far advanced:																		
Active	9	4	0	0	1	1	3	2	1	0	1	1	0	0	2	0	1	0
Activity undetermined	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arrested or inactive less than 2 years	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Unspecified stage:																		
Active	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Activity undetermined	12	9	1	1	0	0	4	2	3	0	4	4	0	1	0	1	0	0
Arrested or inactive less than 2 years	2	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0
Inactive:																		
Minimal	321	321	27	30	40	36	59	75	45	27	59	45	25	35	42	40	24	33
Moderately advanced	86	61	3	3	15	7	29	19	6	7	15	7	9	10	5	4	4	4
Far advanced	11	6	0	1	3	0	1	0	0	1	3	1	3	0	1	2	0	1
Unspecified	29	40	1	0	15	20	5	7	2	1	3	6	0	2	2	1	1	3

available awards, which should benefit not only the public health worker who may wish to compete but also those persons or groups who may wish to establish new awards. It would be fitting for new awards to be created for achievements in administration, program accomplishment, and communication.

Omitted from the tabulations are the following categories of honors: (a) those not primarily intended for workers in the field of public health although from time to time those awards may be given to individuals who are also

active in public health; (b) those given for length of service or length of membership; (c) those given for published papers describing research as distinct from those for the research itself; (d) those given to former officers and members for service to the organization; (e) election to Delta Omega or to other honorary societies; (f) scholarships and fellowships; (g) honorary lectureships.

[*Public Health Reports* welcomes supplementary information which may be used in possible future revisions of this tabulation.—ED.]

### Public Health Awards

Name, sponsor, and administrator <sup>1</sup>	Type <sup>2</sup>	Eligibility for award	Basis
American Hospital Association Award of Merit. American Hospital Association (S, A).	Medallion and scroll.	Hospital administrators.	Outstanding accomplishments in the hospital field and in improving hospital care.
American Occupational Therapy Association Award of Merit. American Occupational Therapy Association (S, A).	Citation certificate; number not fixed.	Members -----	Outstanding service to field.
Anderson Service Award. American Association for Health, Physical Education, and Recreation (S, A).	Certificate; no more than 6 per year.	Nonmembers-----	Outstanding contributions to field; may be general educator or doctor.
Axson-Choppin Award. Louisiana Public Health Association (S, A).	Plaque. . . . .	Citizen not connected with health department.	Outstanding contributions to health progress in State.
Bell Award. National Association for Mental Health (S, A).	Trophy . . . . .	Newspapers-----	American daily newspaper which during the preceding year had made an outstanding contribution in the fight against mental illness.
Biggs Medal. New York State Public Health Association (S, A).	Medal----- . . . .	Public health workers.	Contribution to public health.
Blakeslee Award. American Heart Association (S, A).	\$500 each and scroll. Generally 4 given —1 each for newspapers, magazines, books, and radio and television.	Authors, newspaper writers, producers, publishers, and so on.	Creative efforts in any medium of mass communication judged to have contributed most to public understanding of the progress in research and in the prevention, care, and treatment of heart and circulatory diseases.
Borden Awards. The Borden Company (S): American Home Economics Association (A).	\$1,000 and gold medal.	Members. . . . .	Fundamental research in the field of nutrition and experimental food, reported in public documents or official journals.
American Institute of Nutrition (A).	-----do-----	-----do-----	Distinctive research which has emphasized the nutritive significance of the components of milk or of dairy products.
American Veterinary Medical Association (A).	-----do-----	-----do-----	Outstanding research contributing to dairy cattle disease control.
Bruce Memorial Award. American College of Physicians (S, A).	\$250, bronze medal, and travel expenses.	Anyone-----	Outstanding accomplishments and contributions in the field of preventive medicine.

Footnotes at end of table.



# Public Health Awards

By HOMER N. CALVER, B.S.

NEARLY 50 awards are given regularly in the field of public health, most of them annually. They are administered through more than 30 national, State, and local organizations. With few exceptions these awards go to individuals and are presented at the annual meeting of the administering organization.

In addition to the scroll, plaque, medal, certificate, or trophy which the winner receives there is sometimes an honorarium, ranging in value from \$50 to \$2,500. The presentation ceremony usually includes a résumé of the recipient's career and references to the accomplishments that brought him the award.

An analysis of these public health awards (see table) was undertaken by the Public Health Committee of the Paper Cup and Container Institute when it decided to establish an award in the memory of Dr. Samuel J. Crumline. The study revealed that there were no national awards for health departments. This was surprising because of the emphasis on teamwork in public health and the fact that the full-time local health unit has long stood as the symbol of the most desirable vehicle for community public health service.

As one reads the statements which outline the basis for selecting winners of the several awards, there is a notable repetition of the nouns: contribution, service, achievement, accomplishment. They are used in nearly all possible

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## Samuel J. Crumline

Dr. Samuel J. Crumline's distinguished career included service as the first full-time health officer of Kansas and director of the American Child Health Association. Among his pioneer contributions were the crusades he organized against flies and against the common drinking cup and spitting in public places and water pollution. His achievements were, therefore, not only those of an outstanding administrator but those of a leader in the fight for sanitation. Moreover, the impact of his work had been achieved through methods which eventually became an inherent part of what subsequently was called "health education." He died at 91, at which time he was a consultant on the staff of the Paper Cup and Container Institute.

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combinations with these adjectives: meritorious, outstanding, distinguished, exceptional, signal, significant, distinctive. The Pennsylvania Public Health Association, with a refreshing variation of terminology and criterion, offers an award for "enthusiastic leadership."

The awards place considerable emphasis on accomplishments in the field of research, with a corresponding neglect of recognition of administrative and program accomplishments. This, too, is surprising in a field which is essentially one of applied science.

These and similar observations concerning the existing awards led the Public Health Committee of the Paper Cup and Container Institute to conclude that the Crumline Award might be useful if it were made to health departments and the winners were judged on evidence of teamwork within that department and with community groups.

The accompanying table gives an analysis of

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*Mr. Calver, secretary of the Public Health Committee of the Paper Cup and Container Institute, is editor of the Health Officers News Digest. Robert E. Mytinger, assistant to the secretary, made the tabulations.*

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# Public Health Awards—Continued

Name, sponsor, and administrator <sup>1</sup>	Type <sup>2</sup>	Eligibility for award	Basis
Lasker Award. Albert and Mary Lasker Foundation (S). International Society for the Welfare of Cripples (A).	\$1,000 and statuette triennially; number not fixed.	Lay or professional.	Achievement in the development of services for the physically disabled.
Massachusetts Association of Sanitarians Scroll. Massachusetts Association of Sanitarians (S, A).	Scroll-----	Sanitarians-----	Massachusetts sanitarian who in past year did most to enhance the status of the association and public health work.
National Society for Medical Research Citation. National Society for Medical Research (S, A).	Citation certificate; 1-3 per year.	Unrestricted-----	Contribution to public understanding of medical science.
New York State Public Health Association Health Education Information Citation. New York State Public Health Association (S, A).	Citation certificate; 3-4 per year.	Newspaper, radio or television station.	Contribution to better understanding of health matters.
North Carolina Public Health Association Award of Merit. North Carolina Public Health Association (S, A).	Citation certificate----	Group of members associated in some accomplishment.	Outstanding contributions or activities during past year for a local health department or group.
Nutting Award. National League for Nursing (S, A).	Medal and scroll; 1 every other year.	Public health workers—official, non-official.	Outstanding contribution to community welfare through nursing education, nursing service, or through some other areas of public health.
Pan American Gold Medal. National Society for the Prevention of Blindness (S, A).	Medal; 1 every 4 years.	Medical and non-medical public health workers.	Significant contribution to prevention of blindness.
Pennsylvania Public Health Association Award of Merit. Pennsylvania Public Health Association (S, A).	Citation certificate----	All public health workers.	Distinguished service and outstanding contributions to the advancement of public health.
Pennsylvania Public Health Association Honorary Membership. Pennsylvania Public Health Association (S, A).	Scroll; 2 per year----	do-----	Enthusiastic leadership in public health work.
Pickett-Webb Memorial Award. Utah Association of Sanitarians (S, A).	\$50 and scroll-----	Sanitarian-----	Outstanding achievement in field in the State of Utah.
Prentiss Award. Cleveland Health Museum (S, A).	Citation certificate----	Health educator----	Outstanding achievement in health education field.
Public Health Association of New York City Award of Merit. Public Health Association of New York City (S, A).	Certificate in each category.	All public health workers.	Meritorious service to public health in fields of medicine, dentistry, nutrition, nursing, laboratory service, statistics, administration, social work, health education, environmental sanitation.
Public Health Association of New York City Outstanding Service Award. Public Health Association of New York City (S, A).	Plaque-----	do-----	Outstanding service to public health in New York City.
Rankin Award. North Carolina Public Health Association (S, A).	Trophy-----	Members-----	Outstanding contributions to public health in North Carolina over period of several years.
Reynolds Award. North Carolina Public Health Association (S, A).	do-----	do-----	Outstanding contributions to public health in North Carolina, meritorious service above and beyond the call of duty.

Footnotes at end of table.

# Public Health Awards—Continued

Name, sponsor, and administrator <sup>1</sup>	Type <sup>2</sup>	Eligibility for award	Basis
<b>Crumbine Mednl. Kansas Public Health Association (S, A)</b>	Medal... ..	Lay or professional	Outstanding contribution to health of the people in Kansas. May be a native Kansan who has made a major contribution while in another State. Regional or national recognition is desirable.
<b>Crumbine Award. Public Health Committee of the Paper Cup and Container Institute (S, A).</b>	1 plaque and medals as merited	Health unit, health officer and person or persons in unit most directly responsible	Outstanding achievement in the development of a comprehensive program of environmental sanitation.
<b>Crumbine Award. Public Health Committee of the Paper Cup and Container Institute (S, A).</b>	... ..	... ..	Outstanding achievement in the development of a program of eating and drinking sanitation.
<b>Cummings Memorial Award. American Industrial Hygiene Association (S, A).</b>	\$100 for paper at banquet and plaque	Industrial hygienist	Outstanding contributions to the knowledge and practice of the profession of industrial hygiene.
<b>Dann Gold Medal. St. Louis Society for the Blind (S). National Society for the Prevention of Blindness (A).</b>	Medal.....	Medical and non-medical public health workers	(a) Long meritorious service for conservation of vision, for prevention and care of diseases dangerous to eyesight, or (b) research and instruction in ophthalmology and allied subjects, or (c) social service for the control of eye diseases.
<b>Florida Association of Sanitarians Scroll. Florida Association of Sanitarians (S, A)</b>	Scroll.....	Sanitarians .....	Outstanding accomplishments in the field of sanitation.
<b>Gold Heart Award. American Heart Association (S, A).</b>	Scroll and pin, 1 to physician, 1 to layman.	Physician, business, or public health leader.	Outstanding contributions to the advancement of cardiovascular medicine or the heart program.
<b>Gulick Award. American Association for Health, Physical Education, and Recreation (S, A).</b>	Medal....	Members or non-members	Outstanding contributions to field.
<b>International Association of Milk and Food Sanitarians Award. Five detergent manufacturers (S). International Association of Milk and Food Sanitarians (A)</b>	\$1,000 and citation certificate	Sanitarium attached to local health department	Outstanding service and meritorious accomplishment in field of sanitation.
<b>Johnson Annual Award. Missouri Public Health Association (S, A)</b>	Scroll.. ..	Professional public health worker or layman.	Any person who has made an outstanding contribution to public health in Missouri.
<b>Kimble Award. The Kimble Glass Company (S). Conference of State and Provincial Public Health Laboratory Directors (A)</b>	\$500 and citation certificate	Lab personnel	Contributing outstandingly to developing a new and better method in the field of public health.
<b>Lasker Award. Albert and Mary Lasker Foundation (S). American Heart Association (A).</b>	\$1,000, scroll, and statuette	Physician or scientist	Outstanding scientific contribution in the field of cardiovascular research.
<b>Lasker Award. Albert and Mary Lasker Foundation (S). American Public Health Association (A)</b>	\$1,000 and a statuette. Occasionally a special individual award of \$2,500, scroll, and statuette to groups, 4-10 per year	All categories of public health workers. Individuals or groups—official or voluntary.	Outstanding achievements in either research or in administrative application of research in the control of diseases that are recognized as major causes of death.

<sup>1</sup>Footnotes at end of table

# Public Health Research in Chronic Disease

By JOHN E. DUNN, Jr., M.D.

THE changing nature of the health problems that burden our society is becoming increasingly apparent. The severe outbreaks and epidemics of the infectious and communicable diseases are giving way to the endemicity of chronic disease.

"Chronic disease" as a generic term usually conjures up such entities and groups of diseases as heart disease, cancer, mental diseases, and diabetes. Actually, the connotation is broader than the mere disease label. There is the added implication of insidious progression, slow and incomplete recovery, disability, necessity for adaptation on the part of the affected individual, and the host of services—medical, nursing, social, economic, housekeeping, rehabilitation—involved in the struggle between an individual and a chronic disease from which he is trying to recover or with which he is learning to live. A definition adopted by the Conference on the Preventive Aspects of Chronic Disease in 1951 (1) states that "chronic disease comprises all impairments or deviations from nor-

mal which have one or more of the following characteristics: (a) are permanent; (b) leave residual disability; (c) are caused by nonreversible pathological alteration; (d) require special training of the patient for rehabilitation; and (e) may be expected to require a long period of supervision, observation, or care." Although one might wish to quibble with some of the details of this definition, it paints the picture of chronic disease essentially as seen through the eyes of the victim. The summation of such victims in a community delineates the problem of public health.

A definition of chronic disease has been considered; it would seem unnecessary to define research. Here too, however, there are differences of opinion as to what should be included in the term. Such modifying adjectives as "applied," "field," "clinical," "epidemiological," and "administrative" are used to distinguish the fuzzy limits of what can be encompassed by so jealously guarded a term as research. If we consider research as a quest for knowledge and view the chronic disease problem from the vantage point of public health responsibility, we are immediately impressed with the fragmentary nature of knowledge and the rather general ignorance of the whole spectrum of chronic diseases and their chronology from etiology to recovery, symbiotic stabilization, or death. In this discussion research in chronic disease is considered in its broadest sense and from the standpoint of public health responsibility. Since I am working in the can-

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*Dr. Dunn is a field investigator with the Field Investigations and Demonstrations Branch of the National Cancer Institute, National Institutes of Health, Public Health Service, assigned to the bureau of chronic diseases, California State Department of Public Health. This paper was presented at the 1955 meeting of the Western Branch of the American Public Health Association, Phoenix, Ariz.*

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# Public Health Awards—Continued

Name, sponsor, and administrator <sup>1</sup>	Type <sup>2</sup>	Eligibility for award	Basis
Ross Medal. National Tuberculosis Association (S, A).	Medal-----	Persons other than medical practitioners or medical scientists.	Outstanding and distinguished contribution to tuberculosis control in some field other than the medical sciences.
Sabin Award. Colorado Public Health Association (S, A).	Citation certificate---	Usually lay-----	For outstanding contribution to public health outside of professional responsibilities.
Sedgwick Award. American Public Health Association (S, A).	Medal-----	Individual public health workers.	Distinguished service in public health.
Shattuck Award. Massachusetts Public Health Association (S, A).	-----do-----	Unrestricted-----	Outstanding contribution to public health in New England.
Sippy Memorial Award. Western Branch, American Public Health Association (S, A).	Plaque-----	Public health personnel.	Outstanding contributions to the promotion of public health in the association's district in which the annual meeting is held.
Trudeau Medal. National Tuberculosis Association (S, A).	Medal-----	Medical and non-medical.	Most meritorious contribution on the cause, prevention, or treatment of tuberculosis.
Weinstein Award. United Cerebral Palsy Association (S, A).	\$1,000 and plaque---	Scientists in scientific research.	Outstanding recent scientific research in field of cerebral palsy.
White Memorial Award. Louisiana Public Health Association (S, A).	Plaque-----	Member of the State department of health.	Meritorious contribution to health work in the State over prolonged period.

<sup>1</sup> S—Sponsor; A—Administrator.

<sup>2</sup> Except as noted, 1 award is given each year.

## Chlortetracycline as a Preservative

The antibiotic chlortetracycline may now be used as a preservative for uncooked poultry. First marketed as aureomyein, the chemical will be sold under the trade name Acronize chlortetracycline. The Food and Drug Administration ruling, announced November 30, 1955, marks the first time an antibiotic has been permitted in food processing.

According to submitted data, chlortetracycline, added to the water in which the poultry is chilled after dressing, retards development of spoilage organisms and thereby prolongs the freshness of the poultry. Effectiveness of the process depends upon its application to clean, freshly killed birds.

FDA has set a tolerance of 7 p.p.m. for residue of chlortetracycline remaining in any portion of the uncooked bird. FDA's decision was based on evidence that cooking destroys this amount of chlortetracycline so that none is left when the poultry is served.

Permission was granted in accordance with provisions of the Miller amendment to the Federal Food, Drug, and Cosmetic Act, which authorizes the fixing of tolerances for pesticide residues on raw agricultural products, provided there is suitable evidence of usefulness and of the safety of the permitted residues. With this exception, FDA has not changed its basic position that the law bans the use of antibiotics in human food.

disease problem and partly from the lack of research equipment and techniques having the precision and accuracy of those available to the laboratory investigator. I am referring to the epidemiological study of chronic diseases. Man is a complex animal who has evolved a complex and largely artificial social structure within which to live. Not all economic and technological progress is necessarily good for him in a biological sense. He eats too much, smokes too much, drinks too much, and lives under too much tension. Evidence is accumulating to indicate that these, and other factors much less obvious, play a part in the occurrence of chronic disease. Epidemiologically speaking, then, the soil should not be neglected in preoccupation with the seed. Epidemiology is primarily a tool of public health.

Cancer has perhaps received more attention, meager and superficial as it has been, than any of the other chronic diseases regarding the characteristics and attributes of people that are related to the occurrence of the disease. Most of this comes under the classification of descriptive epidemiology and has perhaps served to raise more questions than it has answered. Much of what has been learned in cancer epidemiology, or endemiology as some would prefer to call it, has had to come from existing data, such as mortality records, or from short-term retrospective studies that could be handled with limited finances. Nevertheless, some rather clear-cut and specific findings have come out of such investigations, such as bladder cancer as a result of beta-naphthylamine exposure in the aniline dye industry, chromate cancer in the chromate industry, the direct relationship of the amount of solar radiation and the frequency of skin cancer, the relative immunity of Jewish women to cervical cancer, and, more recently, the association of cigarette smoking and lung cancer. Other established associations are in need of further explanation. Cancer of certain sites has been shown to exhibit a socioeconomic gradient. For example, cancer of the upper gastrointestinal tract and stomach and cancer of the cervix show an increasing incidence as economic status decreases. A gradient in the opposite direction is shown by cancer of the breast and ovary. These findings originated from studies carried on in England and,

later, in Denmark. Recently, studies to determine the existence of such gradients in this country have been undertaken, one of which is nearing completion for San Francisco. The findings of these several studies differ in certain details but confirm the fact that cancer of certain sites does have socioeconomic gradients.

Isolated studies concerning cancer of the cervix have shown association of this disease with a multiplicity of variables, including the fact of marriage, age at marriage, childbearing, economic status, stability of marriage, syphilis, circumcision of spouse, and race. Certainly, there is need and opportunity for unraveling this multiplicity of variables, many of which are correlated with each other.

Recently, there has been a trend toward use of the more expensive and time-consuming, but much more satisfactory, prospective type of epidemiological approach. Perhaps this indicates a more general realization of the contribution that the methods of epidemiological study can make to the problems of the chronic diseases. The findings relative to cigarette smoking and lung cancer have been confirmed by such studies in both this country and England (5, 6). A byproduct of considerable importance from both of these studies was the finding that cigarette smoking is also associated with coronary heart disease. A finding such as this could not, of course, come from a retrospective study of lung cancer patients. A study is now under way in California in which the lung cancer risk of certain occupations is being determined. A previous study of the case-control type indicated that certain occupations carried an increased risk of lung cancer. At the present time, populations of workers engaged in these suspect occupations are being assembled, and their lung cancer experience will be determined over the next several years by checking all cancer deaths among males occurring in the State against these assembled populations.

It was determined that populations of 5,000 to 10,000 individuals would be necessary in order to have a reasonable expectancy of lung cancer mortality during the study period. Data on such large numbers would be difficult to collect from industrial establishments, and mailed

cer field, I will draw on that subject for illustrative purposes.

## Areas of Research

Chronic diseases and conditions are problems of public health for one or more of the following reasons: (a) their relative importance as causes of death; (b) their responsibility for prolonged disability, during which time the affected individual is not self-sufficient, with all that this implies; and (c) the ability of the community, through organized effort, to meet many of the problems that are difficult or insoluble for the individual.

Public health has a need of knowledge of the whole chronology of chronic disease, from the characteristics, habits, and surroundings of individuals that give them a special proclivity for a certain disease or diseases, as, for example, current interest in obesity and cigarette smoking, to the requirements of the individual with stabilized disease which will return him to an active, useful life. The chronology of chronic disease for the purpose of this discussion can be conveniently, although somewhat arbitrarily, divided into the following stages: (a) the pre-disease period, during which the unknown and suspected etiological factors are operating; (b) the incipient stage, when the disease is recognizable by some clinical or laboratory means but is not yet symptomatic; (c) the full-blown symptomatic stage; (d) stabilization of the disease process and maximal recovery; and (e) restoration of the patient to useful life. The first two stages are the most appealing to preventive medicine and public health and the actual or potential means for attacking chronic diseases at these stages have been designated primary and secondary prevention, respectively (1). The third stage, of course, is the period for skilled medical management. The fourth and fifth stages are periods when the individual is in greatest need of assistance and services from various community resources, that may or may not exist, in his effort to become an active useful person again.

### *Etiology*

It is difficult to deal with a disease empirically. It is understandable, then, why primary

interest should center on laboratory and clinical research to elucidate the etiological and pathogenic mechanisms of the chronic diseases. We have only to look at the tremendous increase in the amount of money that has been made available for medical research in recent years, much of which is directed toward study of the etiology and pathogenics of the chronic diseases, to realize the urgency felt for knowledge to combat the ever-increasing burden of disability and death for which these diseases are responsible. It is estimated that in 1952 the Nation spent an estimated \$180 million for medical research: 42 percent came from government sources; 33 percent, from industry; 14 percent, from private philanthropy; and 11 percent, from hospitals and medical schools. The total amount is a tenfold increase over the expenditures for medical research of a decade before (2). In 1952, the Public Health Service administered \$18 million of grant funds to support medical research in addition to the funds for its own growing research program. The recent opening of the Clinical Center of the National Institutes of Health is a big step forward in furthering the research effort toward solving the problem of chronic disease development.

Almost every scientific discipline of the biological and natural sciences is represented somewhere on the research team attacking the array of morbid processes included in the chronic diseases; and research interest ranges from a study of the simplest biological systems to the response of whole organisms to experimental conditions. The volume of research findings is tremendous and is not easily synthesized into a total picture. However, there can be little doubt that the picture can be completed and the etiology and pathogenesis of the chronic diseases understood. From the public health vantage point, these research developments are to be viewed with keen interest and hope that better means of anticipating, diagnosing, and treating the chronic diseases will evolve.

Despite the momentum that chronic disease research is gathering, there is still the feeling that insufficient emphasis is being directed toward certain approaches to the study of the occurrence of chronic disease (3, 4). This stems partly from a lack of personnel with disciplinary training oriented to the chronic

as a tie-in or bonus feature of some other medical service; and (b) screening the population at risk periodically, the frequency to be determined from knowledge of the usual period between the time the screening procedure can first indicate presence of the disease and the time the disease will become manifest.

One important question is, How frequently should a screening procedure be repeated? Initial multiphasic screening of a population largely deals with prevalence of undiagnosed disease. Prevalence is the product of incidence times duration. If one disease has one-fifth the incidence of a second disease in a given population, but the former existed 5 years on the average asymptotically and the latter, 1 year, the findings in terms of numbers of cases of the two diseases in an initial screening will be the same. However, annual repetition of the screening would produce only one-fifth the number of new cases of the first disease, whereas the second disease would continue to be found in the same numbers. Perhaps repetitive screening for the first disease could effectively and economically be done on a 3- to 5-year cycle. The second disease is committed to annual screening.

One means of evaluating the accomplishments of multiphasic screening would be to compare the course of the cases of a disease so identified with the course of the same disease when first recognized symptomatically. Here we may be misled. Many diseases show a range of rates of progression. The slower-developing and more benign forms of the disease accumulate disproportionately among the undiagnosed, asymptomatic, cases of prevalent disease. Under these circumstances the prognosis for the prevalent cases as a group is more favorable than the prognosis for the incident cases.

Cancer is a disease for which more is at stake in earlier diagnosis perhaps than in any other of the so-called chronic diseases. Among the diseases usually grouped in the chronic disease category, symptomatic cancer is one of the more acute. It is primarily a killer, having the dubious distinction of ranking second in this capacity. Cancer is not found among the chronic diseases listed as responsible for the greatest amount of disability, either in terms of individual cases or collectively for all cases of specific diseases.

Since clinically recognizable cancer, that is, gross tumors that are obvious to direct or X-ray visualization, is such an acute disease, we have a narrow margin of time within which to accomplish asymptomatic diagnosis as a substitute for symptomatic diagnosis. Furthermore, we are forced to search for individual tumor masses at all the sites where they frequently occur because there is no established general pathophysiological change yet discovered associated with the development of cancer that is qualitatively or quantitatively sufficiently unique to serve as a general test procedure.

The cure rate for lung cancer, which has increased so remarkably in recent decades, is negligible when the disease has become symptomatic. Lung tumor masses can be identified in chest X-ray films before symptoms occur. Is this an effective and practical screening procedure for cancer of the lung? The lung cancer results of the Los Angeles mass X-ray survey suggest that X-ray screening can identify cases somewhere in the range of 9 months to a year prior to symptomatic diagnosis. Is this enough earlier to influence prognosis? There is some evidence from the Los Angeles data that it is (10), although the improvement still leaves much to be desired. Is the amount of improvement in prognosis real or are the results biased by an undue proportion of slower-growing tumors that can be expected among prevalent cases, as commented on earlier? Other sources of bias are likely in a survey of this type, and the results therefore cannot be regarded as definite. If it is felt that periodic X-ray chest examinations at 6-month intervals has real promise as a means of bettering the prognosis of lung cancer, it is worth a thorough, properly designed study of repetitive examinations in the same population.

The best example of a more hopeful aspect of discovering asymptomatic cancer is the use of exfoliative cytology for cancer of the cervix uteri. Contrary to what was said earlier regarding clinically recognizable cancer (visible gross lesions), the study of cervical cancer with cytology, whereby microscopic lesions without gross abnormality can be identified, suggests that cancer may be a very chronic disease, with the clinical stage as usually recognized being the explosive and lethal phase. The evidence



questionnaires became of necessity the method for collecting data. Union organizations seemed to offer the best means of gaining access to the occupational groups to be studied. The union organizations have proved to be very cooperative and the percentage of mailed questionnaires completed and returned has ranged between 85 and 90 percent, a most gratifying response. It is expected that the more than 25,000 workers that have entered the study will be increased three- or fourfold before the study populations are closed.

A few years ago a long-term study of heart disease was undertaken in Framingham, Mass., in which some 5,000 individuals were examined. These individuals will be followed over the next several years to determine the factors associated with the occurrence of heart disease. A study of coronary heart disease among London double-deck bus operators showed that conductors had fewer and milder cases of the disease than did drivers (7). It was hypothesized that the greater physical activity demanded of conductors in their work might be responsible for this finding. This explanation was supported by similar differences found for physically active and sedentary workers among postal workers and civil servants.

From these illustrations, it should be clear that the epidemiological method can make significant and worthwhile contributions to the understanding of the occurrence of chronic disease. Perhaps the time has come for public health workers to take a more active part in contributing what can be learned from population studies to these problems that are destined to absorb most of our interest and efforts in the near future.

#### *Incipient Stage and Case Finding*

It is generally agreed that diseases are more effectively treated if they are recognized in their early stages. This is particularly true for the chronic diseases where progressive and more or less permanent damage is a prominent feature of the pathological processes. In cancer control, the whole program is based on the concept of early recognition and treatment since success or failure is clearly centered on the time when metastasis occurs.

The problems connected with recognition of

the incipient stage of chronic disease are twofold: What techniques do we have for their recognition? How do we use them effectively? These two questions are intimately related to each other. A procedure that is technically difficult, time consuming, and expensive is hardly adaptable to examining the general population for unsuspected disease, for example, conventional gastrointestinal series for X-ray examination of the alimentary canal for possible cancer. On the other hand, procedures that are technically suitable for general application but lack sensitivity, specificity, or both will fail from lack of efficiency. An example would be a cancer test based on quantitative changes in the normal serum proteins that occur with this disease, or these diseases, as some prefer.

Dissatisfaction with the number of cases of symptomatic tuberculosis that were coming to diagnosis in the advanced stages led to technological development of miniature X-ray films and successful mass application of the new technique to screening the general population for cases of minimal, asymptomatic tuberculosis. Similar applications have been made of syphilis serology. Cancer detection centers were an outgrowth of this concept. It was natural to extend the concept to multiphasic screening, that is, combining screening procedures to look for a number of diseases simultaneously. So far, attempts to apply this method of identifying incipient and asymptomatic diseases have been sporadic and isolated. Reactions to these attempts have varied. They have been condemned as poor medicine and bad public health (8). However, multiple screening is considered to have a place if it can be meshed with the normal flow of patients through medical channels, such as physicians' offices, outpatient departments, hospitals, and industrial medical examinations (9).

The basic question, however, seems to me to be whether screening procedures can be the means for bringing the diseases in question under medical management in an incipient or asymptomatic stage rather than in the symptomatic stage when diagnosis is usually made. This implies two things: (a) making the procedures available to the general population, or to those segments at major risk from the diseases being sought, as a direct service and not

research is certain to come an understanding of the detailed mechanism of many of the chronic diseases and, from this understanding, the development of many specific and potent therapeutic agents will follow.

This is a phase of chronic disease research which is not directly related to public health responsibility. Interest has been extended to an evaluation of the efficacy of therapy, such as the use of tumor registries in the cancer field. Therapeutic advances can have considerable effect on the community load of the disabled and incapacitated chronically ill which is a direct interest and responsibility of public health.

### *The Chronically Ill Population*

The philosophy of chronic disease control is to prevent and to mitigate the burden of chronic disease that is now prematurely disabling and incapacitating large numbers of our population. It has been estimated that 4,000,000 persons in the United States are continually victimized by these conditions, three-fourths of them under 65 years of age (12). Even with postponement of death through control of disease there will always be a need for community services for those reaching the incapacity of old age and terminal illness (13).

### **Public Health Responsibility**

How can public health assay its responsibilities for the chronic diseases without defining the problem in terms of numerical size; relative importance of the various diseases and injuries in terms of incidence and prevalence; nature of the incapacities; type of care being given, by whom, and in what degree of adequacy; unmet needs and who can best provide them; availability of community services and facilities; possibilities for rehabilitation and the availability of this service; and a host of other questions that require answering as the chronic disease problem is dissected and analyzed? A number of morbidity studies are going on now—in New Jersey, Baltimore, and the State of California—to answer many of these questions. In other studies, such as that of the Community Studies, Inc., of Kansas City, Mo., the possibilities and cost of rehabilitating the handicapped and chronically ill are being determined.

The generalizations that can be drawn from these studies will be helpful in gaining insight and in providing guidelines for understanding and planning programs to aid and rehabilitate the chronically ill. Each community, however, will have to examine its own problem, do the best it can with what it has, and attempt to discover and rectify its weaknesses. Such community introspection perhaps cannot be graced with the designation of research, but here is where the problem and the solution lie for the care and rehabilitation of our chronically ill.

### **Summary and Conclusions**

1. The chronology of chronic disease is considered from the standpoint of public health interest and responsibility.

2. There has been greatly increased financial support for research directed toward the chronic diseases in recent years, with major emphasis on laboratory and clinical research.

3. The epidemiological method, primarily a tool of public health, has been relatively neglected as a research approach to studying the chronic diseases.

4. Case-finding methods have been inadequately evaluated. A number of questions are posed that must be answered before these methods can be used intelligently and with predictable results.

5. Laboratory and clinical research will eventually elucidate the mechanisms of many of the chronic diseases. Some of these findings will be found adaptable for practical application as preventive measures. These findings should also be scrutinized for adaptation as more discriminatory case finding methods.

6. Advances in therapeutic management give promise of better control of the chronic diseases from the standpoint of stopping or delaying progression before disability and incapacity result.

7. As of now, however, there is a sizable and growing burden of chronic illness and disability among our people which will always be with us in some degree. Public health has the responsibility of studying the problem and contributing its skills to the prevention and control of these diseases, and the support and rehabilitation of those affected.

indicates that there is a preinvasive stage that lasts for several years. Periodic searching for evidence of this lesion, which would seem to be almost certainly curable, may be successfully accomplished at 2-, 3-, or 4-year intervals. A study now in progress in Memphis, Tenn. (11), is using exfoliative cytology to determine whether cervical cancer can be made a relatively nonlethal disease when the general population of females is periodically screened by this procedure. Unfortunately, the cytological method is not well adapted to screening for other sites of cancer because of the technical difficulties of obtaining specimens.

The more important questions relative to the substitution of asymptomatic diagnosis for symptomatic diagnosis of the chronic diseases are:

1. What procedures do we have that are technically suitable for mass application?

2. How efficient are these procedures in terms of sensitivity and specificity when used in the asymptomatic general population?

3. What is the pattern of the specific diseases that are being sought in terms of incidence, prevalence, age, and sex selection, and so on?

4. How much earlier, on the average, can the screening procedure pick up the specific disease than it is usually diagnosed as a result of symptoms?

5. As a corollary to this, what is the cyclic frequency for most practical and efficient use of the screening procedure?

6. What is the advantage in prognosis for cases of the disease identified by the screening procedure as compared to those progressing to symptomatic diagnosis?

If intelligent and efficient use is to be made of the concept of multiple screening, such questions as these must be answered no matter how the method is to be applied. If the idea is to be effective in improving the total chronic disease picture, it must be promoted in some organized plan in making it continuously available for any population group. Public health has traditionally taken the leadership in case-finding methods and has most to gain from answering questions such as those proposed. This knowledge is needed if we expect to do more than enumerate for demonstration purposes the number of unattended and undiagnosed dis-

eases and defects that are prevalent in any population in which symptoms are the usual basis for seeking medical attention.

### *Symptomatic Clinical Disease*

The symptomatic clinical stage is the stage of disease for skilled medical management. And the emphasis here is on treatment. The therapeutic advances made and being made are spectacular and become matters of public knowledge almost as rapidly as they appear. The antibiotics have become so well established and are available in such variety to meet almost every special purpose for combating infectious agents, that we accept them as part of our medical heritage. The sulfa drugs, which were the marvel of their day, have already passed into that heritage. Current developments in the manipulation of hormones to influence the course of certain chronic diseases, using the concept of metabolic antagonists in cancer chemotherapy, more effective antihypertensive drugs, and so on, are examples of important progress in therapy for the chronic diseases.

Much of the fundamental research that is being so extensively carried on is directed to an understanding of the basic chemical processes of metabolism in the normal state, in disease, and under the influence of therapeutic agents. Interest includes the cellular components identified with metabolic functions; hormonal effects on cellular metabolism and tissue function; the in vivo fate of therapeutic agents in terms of chemical alteration of the agent, specific action in chemical and functional terms, storage, and excretion; and the chemical nature and physical-chemical state of nutritional elements during blood transport, in tissue fluids, and body storage. The development and perfection of research tools such as radioactive isotopes, electron and phase microscopy, electrophoresis, paper chromatography, and high-speed centrifugation have done much to make this detailed and exacting research possible. Many of the advances in specific means of controlling infection, in understanding of the physiological economy of the body, and in improved anesthesia have made possible the extension of surgical procedures in the cardiovascular, cancer, and other fields.

Out of this extensive medical and biological

# *As More People Live Longer*

The eighth annual conference on aging, held during the week of June 27, 1955, at the University of Michigan, Ann Arbor, had an official registration of 804. Representatives of 30 States, the District of Columbia, 3 Canadian Provinces, England, and Sweden attended the general sessions and the various workshops.

Sponsors of the conference were the University; the Department of Health, Education, and Welfare; the Department of Labor; the Civil Service Commission; the Housing and Home Finance Agency; the Council of State Governments; United Auto Workers, Congress of Industrial Organizations; Michigan State Medical Society; and the Michigan State Departments of Employment Security, Agriculture, Health, Public Instruction, Mental Health, and Social Welfare.

The chairman of the conference, Dr. Wilma Donahue, who is chairman of the division of gerontology, Institute for Human Adjustment, University of Michigan, reports that one outgrowth of the conference was the formulation of emerging concepts by which the problems associated with aging might be approached. These observations and principles are presented below in the form of a list of tentative conclusions reported by the conference research seminar.

- The proportion of the people in our society who are old is probably going to remain at about the present level to the end of this century. The number of older persons will increase along with the numbers in all other age groups.
- As with other segments of the population, older people can expect more of the better things of life, more leisure and time for creative pursuits as our national productive capacity expands in line with the extension of automation.
- As a result of our added years, all of us will spend more years in the work force, but these years will constitute a smaller proportion of our lives. There will be further decline in work force participation after age 65.

- There is no immediate prospect of a dramatic rise in the total length of life. There will not be a great increase in the life span, but, as a result of medical progress, more of us will live into the older years.

- By employing the emerging concept of treatment of the whole person as opposed to a focus on a particular disease entity, we are achieving spectacular results in restoring the individual to self-function and to a useful place in society. Moreover, treatment of the total person through utilization of the team approach, and the coordinated services of the community can reduce the period of hospitalization from one-third to one-half.

- It is increasingly recognized that the problems of the later years have their onset in the middle years. Therefore, there is need for increased focus on prevention and planning in the fields of health, income maintenance, use of leisure time, education, and living arrangements.

- We may expect continuing pressure on the part of older workers to remain in the labor force until it is possible to guarantee income security and other meaningful roles.

- The need for income maintenance will continue to be a primary concern, and, if present trends continue, we might expect this income to be derived from deferred earnings in the form of social security, private pensions and related benefits, and to a limited extent from personal savings. Also, the provision of more services, such as adult education, recreation, and preventive health services by the community, will contribute to the improvement of the economic status of older people.

- The kinship and household pattern of three-generation families has all but given way to the separate family unit composed of man and wife or of man, wife, and immature children. To a very large extent, the two generations of grandparents and parents are mutually independent and prefer to follow their peer group relationships.

- It might be expected that increasingly inter-

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## technical publications

### Education for the Professions

*Office of Education Publication. By Lloyd E. Blanch. 1955. 317 pages. Paper, \$1.75; buckram, \$2.75.*

This detailed and extensive sourcebook on education for the leading professions in the United States describes these professions and reports on their development and current status of education. It indicates some of the major problems in professional education, lists schools offering professional curriculums, and presents additional reference information.

Twelve chapters are devoted to the health professions: chiropody, dentistry, hospital administration, medicine, nursing, occupational therapy, optometry, osteopathy, pharmacy, physical therapy, public health, and veterinary medicine. Other fields

include accountancy, agriculture, architecture, business administration, engineering, forestry, home economics, journalism, law, library service, music, public administration, social work, teaching, and theology. There are also chapters covering the education of officers in the Army, Navy, Marine Corps, Air Force, Coast Guard, and Merchant Marine.

### Outpatient Psychiatric Clinics, 1954

*Public Health Service Publication No. 428. 1955. 44 pages. 35 cents.*

The first in a series of publications compiled in connection with the new national mental health clinic statistics program, this listing is intended to serve as an interim reference on existing clinics. It is for

the use of professional personnel in community agencies throughout the country.

Name and address of each facility meeting a uniform definition of an outpatient psychiatric clinic are listed by State and location. Appendix A gives headquarters of clinic outlets by State and appendix B, agencies designated as State and Territorial mental health authorities.

This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

# Survival of Enteric Organisms in Sea Water

By ARNOLD E. GREENBERG, S.M.

THE increased use of ocean beaches and tidal areas for recreational activities and commercial shellfishing, coupled with the increased volume of sewage being discharged into the ocean and the heightened interest in general pollution control, has served to make the problem of salt water contamination acute. This is especially true in a coastal area such as California, which is experiencing a tremendous population growth.

Although the problem of controlling this contamination is basically an engineering one, a public health laboratory can be of real assistance in compiling and evaluating available information on the occurrence and survival of enteric organisms in sea water. Consequently, a review of the literature is reported by the division of laboratories of the California State Department of Public Health.

The reader's attention is called to two references which are of particular interest and value. These are Zobell's *Marine Microbiology* (1), a book which deals with the entire problem of micro-organisms in the sea, and Moore's com-

prehensive review on the contamination of ocean beaches (2).

## Some of the Early References

For more than half a century it has been known that sea water can be significantly contaminated by human wastes and that this contaminated water may be a factor in the transmission of enteric diseases either through the direct use of the water or indirectly through shellfish which have been exposed to it. The first study on this subject was reported in 1885 by Nicati and Rietsch (3), who were able to recover the cholera vibrio from the water of the old harbor at Marseilles during a cholera epidemic. In a series of laboratory experiments they showed that the survival of *Vibrio comma* varied in different waters. For example, the organism could be recovered from sterilized harbor water 81 days after inoculation, while in sterilized water from the open sea the survival time was reduced to 64 days. In polluted fresh water, however, the organism could not be recovered after 32 days.

In studying the Bay of Naples, de Giacca (4) determined that enteric bacteria die off rapidly in the sea. In heat-sterilized sea water the typhoid bacillus and the cholera vibrio survived 25 and 36 days, respectively, while in raw sea water they persisted for only 9 and 4 days. He found that the total number of bacteria markedly affected the survival of the cholera bacillus; there was an inverse relationship between total bacterial count and survival time. He isolated a number of strains of marine bac-

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*Mr. Greenberg was appointed chief, sanitation laboratory, division of laboratories, California State Department of Public Health in February 1955. Formerly research microbiologist, University of California Sanitary Engineering Research Laboratory, Mr. Greenberg is also author of papers on biological stabilization of industrial wastes, biological treatment of radioactive wastes, and reclamation of sewage water.*

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generational relationships will become voluntary in nature as opposed to socially defined, legal, or moral obligations. These relationships will instead be based on affection, congeniality, and mutual interests.

- There is much evidence that leisure will occupy a greater proportion of our lives. This has clear implications for community provision of additional facilities and services for leisure-time pursuits for all generations.

- There exists in many communities a need for the coordination of medical and social services to reduce the problems of institutional medical care and the costs of such care of the old.

- Older persons can do much toward minimizing their own personal adjustment problems by contributing their services where they reside in cooperation and in participation with all other age groups in helping to meet the community needs.

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*A brief summary of the conference appears in the September 1955 issue of Geriatrics. Some of the other materials presented at the conference will be published by the University of Michigan Press during the spring of 1956 in a book entitled "Aging's New Frontiers."*

## Federal Surplus Property

Federal surplus property costing \$56,667,227 was distributed to States for public health and educational purposes during July, August, and September, 1955, by the Department of Health, Education, and Welfare.

Under the Federal Property and Administrative Services Act of 1949, the Department channels surplus property to State and local government agencies and to

nonprofit institutions, which are exempt from Federal taxes, in the fields of public health and education.

Property transferred includes school and hospital building sites, buildings suitable for students or faculty, motor vehicles, furniture, tools, laboratory equipment, and school and office supplies. Most of the surplus property comes from the Department of Defense.

### Disposition of Federal personal and real surplus property (acquisition cost), July 1-Sept. 30, 1955

State	Personal property	Real property	Total	State	Personal property	Real property	Total
Totals.....	\$54,133,736	\$2,533,491	\$56,667,227	New Hampshire.....	209,710	-----	209,710
Alabama.....	1,174,892	25,358	1,200,250	New Jersey.....	1,179,953	-----	1,179,953
Arizona.....	32,329	-----	32,329	New Mexico.....	232,577	139,077	371,654
Arkansas.....	449,307	98,100	547,407	New York.....	3,506,972	-----	3,506,972
California.....	5,493,933	725,565	6,219,498	North Carolina.....	1,249,094	-----	1,249,094
Colorado.....	1,017,369	-----	1,017,369	North Dakota.....	103,390	-----	103,390
Connecticut.....	962,840	-----	962,840	Ohio.....	1,721,176	20,416	1,741,592
Delaware.....	318,362	-----	318,362	Oklahoma.....	858,730	65,960	924,690
Florida.....	1,753,490	7,620	1,761,110	Oregon.....	1,106,460	-----	1,106,460
Georgia.....	844,647	-----	844,647	Pennsylvania.....	3,301,563	-----	3,301,563
Idaho.....	-----	-----	-----	Rhode Island.....	431,698	-----	431,698
Illinois.....	1,783,044	42,608	1,825,652	South Carolina.....	1,235,899	-----	1,235,899
Indiana.....	793,322	-----	793,322	South Dakota.....	315,917	-----	315,917
Iowa.....	815,802	-----	815,802	Tennessee.....	1,266,752	404,165	1,670,917
Kansas.....	832,691	-----	832,691	Texas.....	2,388,019	383,696	2,771,715
Kentucky.....	1,049,507	260,611	1,310,118	Utah.....	954,558	-----	954,558
Louisiana.....	623,519	1,503	625,022	Vermont.....	225,509	-----	225,509
Maine.....	367,103	-----	367,103	Virginia.....	976,827	5,000	981,827
Maryland.....	1,214,185	-----	1,214,185	Washington.....	1,035,051	133,000	1,168,051
Massachusetts.....	2,558,355	3,500	2,561,855	West Virginia.....	570,831	-----	570,831
Michigan.....	1,173,749	32,921	1,206,670	Wisconsin.....	1,189,517	-----	1,189,517
Minnesota.....	1,244,513	-----	1,244,513	Wyoming.....	88,101	-----	88,101
Mississippi.....	1,013,894	-----	1,013,894	Alaska.....	-----	18,091	18,091
Missouri.....	1,451,699	46,475	1,498,174	District of Colum- bia.....	445,908	53,935	499,843
Montana.....	94,016	13,590	107,606	Hawaii.....	154,204	52,300	206,504
Nebraska.....	1,615,588	-----	1,615,588	Puerto Rico.....	593,322	-----	593,322
Nevada.....	113,842	-----	113,842				

sults of such experiments may, therefore, have little sanitary significance.

Zobell (18) avoided this objection by using sewage bacteria directly, without cultivating them in the laboratory. Comparing the survival of these bacteria in sea water and sewage-diluted sea water, he found that a concentration of 5 to 10 percent of sea water favored the survival of bacteria, whereas higher concentrations produced rapid killing. In 75 percent sea water the bacterial count was reduced to 39 percent of the original in 2 hours.

The general problems of the discharge of sewage into the Atlantic and Pacific Oceans have been discussed, respectively, by Weston (19) and Warren and Rawn (20). They indicated that enteric bacteria occur in significant numbers only in such places as tidal zones, harbors, and bays.

Zobell (21) confirmed these observations by finding coliform bacteria absent in 961 samples taken from the open sea but regularly present in samples from bays and estuaries. He attributed the die-off of coliform bacteria to the paucity of organic matter and the activity of predatory organisms, believing sea water itself, however, to be slightly toxic for *E. coli*.

Carpenter, Setter, and Weinberg (22) observed that sea water has considerable disinfecting properties on fresh sewage organisms. In their experiments an average of 80 percent of the organisms died in 30 minutes.

The Massachusetts Department of Public Health (23) and Weston and Edwards (24) have reported the results of an investigation made at the Lawrence Experiment Station. After mixing sewage with sea and tap water, at rates of 0.5, 1.0, and 1.5 percent, the total number of bacteria and number of coliforms were followed for 4 days. Both in the raw sewage and the sewage-tap water mixtures the bacterial count decreased slowly, but in the sewage-sea water mixture the decrease was very rapid. No coliforms survived beyond 4 days in the latter mixture.

During the course of examining the Santa Monica beaches, the California Department of Public Health (25) showed that marked coliform reductions occurred in samples of contaminated sea water held for 24 hours. At refrigerator temperatures, from 5 to 20 percent

of the coliforms survived. At room temperature, however, only 1.0 to 2.5 percent of the original number of coliform bacteria could be recovered after 24 hours.

Stryszak (26), working in Poland with several *Salmonella* species, found that the waters of the Gulf of Gdansk (Danzig) produced a rapid kill when the temperature was between 5.5° and 18.5° C. Lower temperatures resulted in reduced kills.

Ketchum and his colleagues (27), in the first of several papers from the Woods Hole Oceanographic Institute, concluded that coliform bacteria rapidly disappeared from normal sea water. This disappearance was more rapid than could be accounted for by such mechanical factors as dilution or sedimentation.

In a later paper from the Woods Hole laboratory (28), the bactericidal action of sea water was shown to be the most important factor in decreasing coliform counts. The total reduction was 99 percent.

Buck, Keefer, and Hatch (29) found that coliforms could persist in estuary water for longer than 200 days.

The North Sea has been examined by several investigators who recovered a number of pathogenic enteric bacteria (30). Buttiaux and Leurs (31), for example, found *Salmonella montevideo*. Their experimental work indicated that with 3 species of *Salmonella* there was more than 90 percent kill in spring water in 44 hours but that in sea water the number of survivors was greater.

As a result of studies similar to the ones mentioned, attention has turned to the reasons for the bactericidal effect of sea water and the quantitative determination of its importance. The explanations suggested by Waksman and Hotchkiss (32) for the low numbers of viable bacteria in water have been summarized as follows:

1. The presence in sea water of toxic substances which are destructive to bacteria under natural conditions.
2. The presence of bacteriophage in the water.
3. The adsorption of the bacteria by the sea bottom and their sedimentation.
4. The bactericidal effect of sunlight.
5. The consumption of the bacteria by protozoa and other small animal organisms.



teria which possessed definite antagonistic activity for the cholera bacillus and also for the nonenteric anthrax bacillus. De Giaksa concluded that water of the open sea could probably not be a means of spread of disease but that, in spite of the relatively rapid death rate in harbor water, such water might be infectious. He also indicated that fish and shellfish might be involved in disease transmission.

Fränkel (5), in a like manner, recovered cholera bacilli from the harbor at Duisberg, presumably after contamination of the water by the discharge from a ship on which cholera was present among the crew.

In connection with investigations on the contamination of shellfish and the possibilities of purifying them, a number of observers commented on the survival of enteric pathogens in sea water.

Conn (6) cited Burdoni, who showed that the typhoid bacillus would live in sea water for 14 days.

Foote (7) noted that, in raw brackish water with a salt content of 0.06 to 0.15 percent, the survival of typhoid organisms was a function of temperature, there being greater survival when the temperature was above freezing.

Reille (8) stated that, according to his experiments, sea water was favorable to the survival of typhoid bacteria.

Boyce and Herdman (9), on the other hand, claimed that typhoid bacilli will not flourish in clean sea water, and Klein (10) observed that sea water had a "powerful destructive action" on *Salmonella typhosa* but that survivors could be recovered even weeks after the collection of samples of heavily infected water.

Later, Winslow and Moxon (11), during a study of bathing beaches in New Haven Harbor, Conn., were able to recover large numbers of coliform bacteria. Although they did not discuss the factors which affected the coliform numbers, they did mention that tides and winds played a part in the distribution of bacteria. A combination of flood tide and onshore wind produced the least dispersion and the highest counts.

In a survey of sewage outfalls in Los Angeles, Knowlton (12) found that the coliform count decreased more rapidly than could be accounted for by dilution alone. After collecting samples

with high coliform counts at bathing beaches distant from the outfall, he concluded, "These conditions lead me to believe that *B. coli* contamination may be caused by bathing only."

### Survival in Sea Water

It is obvious from these earlier references that an appreciation of the problem existed long before there were adequate means for studying it. Conflicting reports on the effect of sea water on enteric micro-organisms pointed up the need for much additional work. Although subsequent studies did not all agree in their results, they have shown conclusively that there are factors present in sea water which decrease the survival of enteric organisms.

Trawinski (13), from his observations of the survival of various enteric pathogens in sea water and in the water from sewage outfalls, found that several members of the typhoid group survived for shorter time periods in the outfall water than in water from the open sea.

Burke and Baird (14) reported that fresh water bacteria could survive equally well in fresh or salt water.

Kořínek (15), after attempting to grow a number of fresh water and soil bacteria in media made with sea water, concluded that, although the micro-organisms could grow quite well on a sea water medium, in nature they have only a latent development in the sea.

The cholera vibrio was observed by Kiri-bayashi and Aida (16) to survive, on the average, for only 10 days in the water of Keelung Port, Formosa, but in the laboratory it survived longer.

In a series of carefully conducted experiments Beard and Meadowcraft (17) studied the survival of pure cultures of *S. typhosa* and *Escherichia coli*. The organisms were put into cells made essentially of a semipermeable membrane, and the cells were suspended in San Francisco Bay. After 35 days no typhoid bacilli and few coliforms could be recovered from the cells.

Experiments using laboratory cultures of the test micro-organisms are of questionable value since it has been shown that laboratory-propagated strains have a greater resistance than naturally occurring bacteria (2, 18). The re-

icity factor is insufficient to account for the observed death rates or survival times.

### Presence of Other Toxic Substances

The presence of other toxic substances has been stressed in recent years.

Zobell and Feltham (36) were among the first to make specific mention of the possible presence of such substances.

Waksman and Carey (39) spoke of "certain controlling factors" injurious to free bacterial development but made no attempt to characterize them.

Careful experimental work is described in an article by Zobell already cited (18). The test bacteria were submerged in the sea within Coors porous porcelain filter tubes impregnated with collodion. This semipermeable membrane permitted the passage of chemical substances from the sea water into the bacterial suspension but did not permit bacterial passage into the sea water. It was found that the death rate of sewage bacteria suspended in autoclaved sea water or sea water which had been passed through a Berkefeld filter was lower than that of bacteria in raw sea water.

A similar observation was made by Kiribayashi and Aida (16), who noted that cholera vibrios survived longer in boiled and sterilized sea water than in the untreated liquid.

Beard and Meadowcroft (17) concluded that the death rate of *E. coli* and *S. typhosa* was higher in unfiltered sea water than in filtered sea water.

Krassilnikov (40) found that a bactericidal factor also was present in the waters of the Black Sea. This factor was active against *E. coli* and was removed by passage of the water through a Seitz filter as well as by boiling or by heat sterilization, and its effect was overcome by the addition of organic matter. At a concentration of 0.1 percent of peptone it was completely absent.

The data of Ketchum, Carey, and Briggs (27) showed that there was a bactericidal principle in sea water which could be destroyed almost completely by autoclaving but only partially by boiling. This factor was not related in any simple way to the chemical composition of sea water. They suggested that the factor

may be an antibiotic substance or an autolytic or degenerative product of the coliforms themselves.

In a continuation of this work, Vaccaro, Briggs, Carey, and Ketchum (41) determined that sea water treated by boiling, autoclaving, pasteurizing, and chlorinating had reduced bactericidal activity. The addition of organic matter also produced reduced activity although not as much as did sterilizing the sea water.

As part of an investigation of the viability of sewage bacteria with respect to shellfish purification, Sherwood (42) found that growth generally occurred in autoclaved sea water but not in raw sea water. By passing the treated water through sterile porcelain filters the effect of autoclaving was removed. Treated sea water which supported the growth of *E. coli* would not permit the persistence of heavy infections of *S. typhosa* or *Salmonella paratyphi* B.

De Balsac, Bertozzi, and Gaudin (43) observed that the bactericidal activity of sea water was independent of salinity, decreased with sample age until it disappeared after 8 to 10 days, was thermolabile, and persisted after passage of the water through a Chamberland filter.

It has clearly thus been established that sea water contains a potent toxic factor which is thermolabile. The isolation and identification of this factor has as yet to be accomplished.

### Presence of Bacteriophage

Numerous investigators have confirmed the presence in sewage of bacteriophages active against enteric bacteria.

As early as 1896 Hankin, cited by d'Herelle (44), noted the effects of bacteriophages.

Arloing, Sempé, and Chavanne (45), as a result of their experiences, believed that the disappearance of fresh water bacteria in the sea was due to the action of specific phages.

Guélin (46), who is one of the foremost students of bacteriophage and its sanitary significance in water, found that bacteriophages active against the coli-typhoid dysentery group were present in the port of Roscoff (France). The number of phages varied directly with the degree of sewage contamination. However, no conclusions were drawn as to the role these

6. The possible presence in the sea of inactive bacteria which are capable of developing only under more favorable conditions of temperature, aeration, and food supply.

7. The lack of sufficient nutriment in the water.

8. The antagonistic relations of other micro-organisms.

It will be convenient to discuss the more important of these categories separately.

### Presence of Inorganic Salts

The most potentially toxic substances present in sea water, on the basis of concentration, are inorganic salts. The salinity of surface sea water is given by Zobell (1) as from 3.3 to 3.7 percent. Near river mouths and other areas of fresh water dilution, this concentration of salts may be appreciably reduced. In inland seas, it may be greater. The effect of high salt concentrations on fresh water or enteric bacteria may be due to differences in osmotic pressure or to the presence of specific inhibitory salt concentrations.

As early as 1890, de Freytag (33) investigated the effect of concentrated solutions of sodium chloride on a variety of bacteria. Unfortunately, he did not mention the salt concentrations used, nor did he compare the survival times with any fresh water controls. He found that, although the typhoid bacillus survived for longer than 5 months, the cholera bacillus died out within 6 to 8 hours.

After comparing the growth of several fresh water bacteria on media containing varying concentrations of sea water, Kořinek (15) concluded that the test organisms could grow quite well on a sea water medium. Furthermore, sea water exerted no marked autolytic effect.

Reporting on the extension of this work, Kořinek (34) noted that fresh water bacteria usually do not compete successfully in the sea with marine bacteria.

The survival of bacteria in an 0.85 percent saline solution and in distilled water was compared by Ballantyne (35), who showed that in either menstruum—in the absence of nutrients—micro-organisms, including *S. typhosa*, were able to survive up to 32 months.

Burke and Baird (14) assumed that the principal factor of difference in fresh water or salt water survival of bacteria was the concentration of sodium chloride. The results they obtained, however, did not support this assumption. Although no data are given in their report and the test micro-organisms are not identified, they claimed that fresh water bacteria survived in sea water nearly as long as in tap water. The length of survival depended on both temperature and the presence of organic matter. Nutrient broths prepared with 2 to 4 times the concentration of salt present in sea water permitted the extended survival of fresh water bacteria. Sea salts other than sodium chloride did not affect viability. Thus, in general, these authors support the viewpoint that inorganic salts affect slightly, if at all, the survival of nonindigenous bacteria in the sea.

Zobell and Feltham (36) in a discussion of marine bacteria mentioned that "the toxicity of sea water for nonmarine bacteria is due not only to its high salt concentration, but to some other factor as well," indicating that they considered the salts to exert some toxic effect.

In a later work Zobell (18) studied the survival of sewage bacteria in artificial and natural sea waters as well as in sodium chloride solutions. He showed that the death rates in the synthetic solutions were markedly different from those in the chemically similar sea water.

The Great Salt Lake in Utah obviously does not contain sea water, but its salt concentration of more than 25 percent makes it interesting in this connection.

Zobell and his associates, Anderson and Smith (37), in an attempt to grow *E. coli* on a lactose medium made with lake water, were unable to observe any gas production or to recover viable coliforms. They stated that the lake water would kill over 95 percent of the sewage bacteria in 1 minute.

Conflicting results, however, were obtained by Fraser and Argall (38), who claimed that *E. coli* was not rapidly killed and that the length of the survival time increased as the temperature decreased.

In summary, it would appear that the usual concentration of salts present in sea water may exert some bactericidal action, but that this tox-

perature; however, at 6° C. approximately 50 percent survived a 24-hour exposure.

Ballantyne (35), in his work with physiological saline, found that *S. typhosa* also survived longer at low temperatures.

In spite of the conflicting reports on the effect of temperature on bacteria in sea water, there is no reason to believe that its effect will be materially different than it is in fresh water or any other aqueous system. Unfortunately, such information is equally conflicting, so that, in any given environment at ordinary temperatures, it is impossible to predict the effect of temperature changes other than to say that the tendency for increased survival is greater at lower temperatures.

### Aeration and Food Supply

The dissolved oxygen concentration, which is a function of temperature, pressure, salinity, and biological activity, may be used to measure the degree of water aeration.

The only information available on the relationship between micro-organisms and oxygen content in natural sea water is the observation by Buttiaux and Leurs (31) that oxygenation of sea water did not affect the survival of *Salmonella typhimurium*.

Waksman and Carey (53) showed clearly that in stored sea water the oxygen content affected bacterial multiplication.

Zobell and Anderson (54) attributed this increase in numbers to the effect on the solid surface of the container, rather than to oxygen tension.

Under most circumstances survival, and more especially reproduction, of bacteria is associated with available nutrient materials.

Russell (47) found that multiplication of bacteria was quite marked in marine muds which are relatively rich in organic matter. He did not comment on the survival of bacteria in waters containing different concentrations of organic matter.

Burke and Baird (14) believed that the presence of organic matter in sea water would increase the survival time of nonmarine bacteria.

Waksman and Carey (39), in their investigation of the decomposition of organic matter in

the sea, concluded that sea water contains enough organic substances in true solution to support an extensive population of bacteria. They did not indicate whether they believed that enteric bacteria or fresh water bacteria could thrive in such an environment.

In another study, Waksman and Vartiomaara (49) showed again that rapid and considerable increases in bacterial numbers took place following adsorption of parent bacteria on marine muds. The neutralizing effect of organic matter on the bactericidal principle in sea water has already been mentioned (40, 41).

Steininger (30) found that at ebb tide the concentration of protein in the standing water of tidal pools was sufficient to provide favorable conditions for the multiplication of *S. paratyphi* B.

An unsigned editorial in the *American Journal of Public Health* (55) commented on the destruction of the bactericidal principle in sea water by autoclaving but not by boiling (27) and suggested that instead of being an antibiotic substance this principle was, in fact, not a toxicity but a starvation problem. Thus, chemical compounds present, but unavailable as nutrients to coliform bacteria, were decomposed by the elevated temperature of the autoclave (but not by boiling) and produced products "which enable the coliform bacteria to maintain themselves more efficiently" (55).

It should not be concluded that under all circumstances the chance of survival or of reproduction of the enteric bacteria is improved by the presence of organic matter. In the event that there is sufficient organic matter present to support growth, a competition between enteric organisms and saprophytes indigenous to either the fresh water or marine habitat would follow. Generally, the enteric organisms would be unequal to the competition. If we consider that the total number of bacteria in the sea is a direct function of the concentration of organic matter, it follows that there will be more competitors of the enteric bacteria as more organic substances occur and that these other organisms, either directly or indirectly, will reduce the growth and survival of the fecal bacteria. This has been shown by de Giava (4) and Kořinek (34).

phages play in the destruction of enteric bacteria.

De Balsac and co-authors (43) believed that the bactericidal activity which they observed was not due to bacteriophages.

There are too few data available to be able to draw sound conclusions on the role played by bacteriophages in limiting the survival of enteric bacteria in sea water. The indications, however, are that the phages are not of the first order of importance.

### Adsorption and Sedimentation

Russell (47) observed that the concentration of bacteria in the Gulf of Naples was highest in the bottom muds. Although he attributed this distribution to the growth and multiplication of indigenous bacteria, he showed that the mud could take up bacteria which derived from the mainland.

Rubentschik, Roisin, and Bieljansky (48) believed that the disappearance of coliforms introduced into the limans or salt lakes of the Odessa region, by drainage from sewage fields, was due primarily to the adsorption of the bacteria on muds. The adsorption capacity of ground sediments in the Chadjibey liman for *E. coli* was quite high. The shallowness of the lakes, particularly near the shore, and the tidal action were responsible for rapid mixing of sediments with the surface water. This in turn produced conditions favorable to adsorption of bacteria.

Waksman and Vartiomaara (49) also found that marine muds had marked adsorptive effects on bacteria. Sand, on the contrary, possessed slight adsorptive properties.

These results are in accord with accepted theories of the nature of soil. Clay and silt, which constitute a major portion of the mud, are electrically charged, and hence, are adsorptively active. Sand, however, not only has a larger particle size and, thus, has less relative surface area, but it is also electrically neutral.

According to the theory held by Dienert and Guillard (50), sea water is neither antiseptic nor inimical to *E. coli*, but sewage discharged into the sea is purified by sedimentation as well as through the activity of predatory organisms.

In a careful study Weiss (51) determined the

adsorptive effect of silt taken from rivers and estuaries. He showed that the degree of adsorption was a function of particle size and the physicochemical nature of the particle. The turbidity found in many natural waters was high enough to yield measurable adsorption of *E. coli*. The end result of this adsorption of bacteria by relatively heavy particles is an increase in the rate of bacterial removal by sedimentation. However, sea water generally reduced the adsorptive capacity of silts, and, furthermore, desorption may have taken place.

It may be concluded that adsorption and sedimentation of enteric organisms do occur, but they will be affected by the nature of the bottom deposits, the rate of desorption, and the rate of water movement, that is, the factors adversely affecting sedimentation. Adsorption and sedimentation do not, in themselves, affect the survival of bacteria but merely tend to remove the organisms from suspension and concentrate them in bottom deposits where they may continue an active existence.

### Sunlight and Temperature

Although a considerable amount of information on the bactericidal effects of sunlight has been accumulated, there are few references dealing with this effect in sea water.

Gaarder and Spärck (52) have studied this phenomenon and considered it to play a significant part in the destruction of organisms in the sea. In all likelihood it is a contributing factor in bacterial destruction but of secondary importance only.

The effect of temperature has been mentioned in some of the references already cited.

Burke and Baird (14) found that fresh water bacteria inoculated into sea water survived longer at 20° to 22° C. than at 7° to 12° C.

Waksman and Carey (53), in studying the effect of storage of sea water on bacterial multiplication, noted that temperature had a marked effect on changes in numbers of bacteria. As the temperature increased to an optimum, the rate of multiplication also increased.

Fraser and Argall (38) reported that in waters of the Great Salt Lake few *E. coli* survived for longer than 8 hours at summer tem-

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## Antibiotics and Animal Predators

De Giaksa (4) was the first to report the existence in the sea of bacteria antagonistic to *V. comma*. After growing these unidentified organisms in mixed culture with *V. comma*, he was unable to produce an experimental infection in animals. Pure cultures of the vibrio were, on the other hand, quite infectious.

Kiribayashi and Aida (16) assumed that the toxic principle in sea water was associated with the presence of saprophytic micro-organisms.

Zobell (18) and Waksman and Hotchkiss (32) observed the bactericidal action of sea water. Waksman and Hotchkiss did not attribute this action to a chemical factor. They found that the toxic agent did not interfere with the decomposition of organic matter as measured by oxygen uptake. Since the reduction in the number of bacteria was not accompanied by a decrease in oxygen consumption, they concluded that other living organisms, namely protozoa and other nanoplankton, were responsible for the reduction.

This point of view was held also by Stryszak (26), who believed that the effect of low temperatures on the increased survival of *Salmonella enteritidis*, *S. typhosa*, and *S. paratyphi B* was due to the thermal inactivation of predatory protozoa rather than to any more direct temperature effect. Similarly, when the concentration of organic matter increased, the population of saprophytes and animal predators did the same. From this effect Stryszak inferred that the predators were most important in the elimination of enteric pathogens from the sea.

Rosenfeld and Zobell (56), in comparing the bactericidal properties of sea water and cultures of antagonistic marine bacteria, found that both the sea water and the cultures suffered losses in activity after filtration through bacteria-proof filters and that both were, on the whole, active against the same organisms. Most of the antibiotic-producing bacteria belonged to the genera *Bacillus* and *Micrococcus*. Although antibiotic activity against *Proteus* sp., *S. typhimurium*, and *Shigella paradysenteriae* was not shown, activity against several gram-positive bacteria was demonstrated. It was concluded that the bactericidal activity of sea water "may be at least partially due to an

autochthonous flora of antibiotic-producing organisms" (56).

Vaccaro and co-workers (41) believed that a normal population of marine bacteria was a necessary condition for bactericidal activity of sea water. They said:

"... the preponderance of evidence thus points toward an antibiotic action, but it can not be stated categorically that all other possibilities have been excluded. The character of the activity is such that it suggests that the bactericidal substance is present in very small concentration."

Ketchum, Ayers, and Vaccaro (28) completed a study of a tidal estuary with a mathematical analysis of the factors contributing to the decrease in coliform counts and showed that bactericidal action was considerably more significant than either dilution or predation. Unevaluated factors were from 3 to 7 times as effective as dilution but were not as effective as bactericidal action in reducing counts.

From the foregoing it may be concluded that the single most important factor in reducing the number of enteric bacteria in sea water is a biological one and most likely is the result of the production of antibiotic substances by marine bacteria.

## Summary and Conclusions

From a review of the literature on the survival of enteric organisms in sea water, it is apparent that these organisms can create a health hazard in estuaries, bays, and especially beaches. The rate of disappearance of the fecal bacteria is greater than that which would be expected from dilution alone. A number of factors are implicated. These include the production by marine bacteria of unidentified, heat-labile antibiotic substances; and adsorption and sedimentation, predation, and competition for the limited food supply. The net result is a partial or complete disinfection or self-purification of sea water. Nevertheless, this bacterial destruction should not be relied on as the sole protection offered to users of sea water.

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*The methods and plan of a pilot study to obtain definitive data on the effects of air pollution on the health of selected cardiac and respiratory patients in their homes.*

# Measuring Reactions to Air Pollution

By JOHN J. PHAIR, M.D., and MAURICE L. THOMSON, M.B., Ph.D

THE nature and extent of the effect of air-borne contaminants upon man's health are still matters for speculation. Most of the available and very scanty data have been gathered from three sources—the broad field of industrial toxicology, the several studies of catastrophes involving large groups subjected to extraordinary exposures (epidemic situations), and in the analyses of morbidity and mortality records.

Clinical and toxicological studies have their principal application in the protection of the industrial worker. The studies usually are supplemented by experimental investigations with animals and men to permit controlled observations of changes resulting from contacts with noxious materials. However, toxic and irritant materials rarely give trouble in an industrial environment until they are present in concen-

trations far greater than ever recorded in the usual urban situation. Consequently, values observed in the plant or obtained in the laboratory are not easily applicable to community problems.

An epidemic is defined as an unusual and widespread occurrence of disease. The catastrophic smog incidents and various accidents fall into this category. Since they represent the extremes, the amount of usable information contributed is therefore necessarily limited.

Analyses of excess morbidity and mortality rates in areas of low and high pollution unfortunately have definite deficiencies. If such data are used, we must assume that uncontrolled factors, such as age, race, and socioeconomic status, have no significance. This assumption obviously is not warranted in the face of considerable evidence to the contrary.

## Epidemiological Approach

Although the three sources of data have certain applications, they do not give enough information to permit the formulation of acceptable solutions for the low-level air pollution problems of cities (endemic situations). Since these situations concern the whole community, population studies using epidemiological techniques immediately come to mind. Today, we expect that a rounded investigation will make use of all approaches—clinical, experimental, statistical, and epidemiological studies of epidemic and endemic exposures.

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## CDC Course in Epidemiology for Nurses

A 3-week course in communicable disease control is offered by the Communicable Disease Center, Public Health Service, Atlanta, Ga., to public health nurses and instructors in communicable disease nursing, beginning May 6, 1956.

The course, designed to increase the technical knowledge and skills of nurses in the prevention and control of communicable diseases, will emphasize epidemiological principles and techniques.

To a limited number of students, field experience under supervision may be available following the completion of the course, May 26.

For further information and for application forms, those interested should write to the director of public health nursing in a State health department or to the Chief, Nursing Section, Epidemiology Branch, Communicable Disease Center, Public Health Service, 50 Seventh Street, N. E., Atlanta, Ga.

therefore, to obtain more specific estimates of the environment for correlation with the patients' reactions. Another reason was the resistance demonstrated daily by smokers and workers exposed to relatively high concentrations of a great variety of irritants. This implied that the observation of apparently healthy or even somewhat incapacitated individuals would not give significant results unless sizable samples were followed for many years.

However, some persons are unusually susceptible—the newly born and those with chronic cardiac or respiratory diseases. Their marked sensitivity due to a low respiratory reserve was notable in the epidemic incidents of London, Donora, and the Meuse Valley. A further advantage can be gained by restricting the choice of subjects to such persons. Since they may be confined or at least significantly disabled, they tend to remain in one locale instead of spending one-third of the day at work, one-third at home, and the remaining third elsewhere. Because exposure in each locale usually differs widely both in degree and kind of pollution, the use of patients with limited mobility diminishes the error of extrapolating environmental measurements made at 2, 3, or more external sampling stations.

As the planning progressed, various considerations led the investigative team to an even more circumscribed approach for the initial effort—use of exact measurements of a small group of selected individuals and their environment. We now believe that until such observations are

available, large field surveys cannot be properly planned or conducted with any hope of success.

### The Pilot Study

In our pilot study in Cincinnati, the pollution to which the test subjects were exposed was measured specifically. Persons with obviously diminished respiratory reserve, as indicated by breathlessness, were chosen and followed during January through April 1955, in order to include several periods of high concentrations of air pollutants. These carefully selected individuals were believed most likely to react clinically to variations in degree and amount of contamination.

The selected goal was to prove or disprove the hypothesis: "Fluctuations in air pollution, as measured by soiling of filter paper, are negatively correlated with variations in the patients' well-being as assessed subjectively by diaries and questionnaires and objectively by instrumental methods." Other useful observations were to be made at the same time, for example, the effect of temperature and humidity on cardiorespiratory patients.

We also hoped to find a more precise relationship between air pollution and well-being than is possible by designating pollution as high and low. Carefully observed clinical responses to many different degrees of air contamination might supply a curve demonstrating a more precise relationship. If a specific association could be demonstrated by such an

Nature of disability of 28 patients studied simultaneously, January–April 1955

Age	Sex		Nature of disability					
	Male	Female	Cardiac		Chest		Cardiac and chest	
			Male	Female	Male	Female	Male	Female
50–54.....	1	3	0	2	1	0	0	1
55–59.....	5	4	3	1	1	2	1	1
60–64.....	1	2	0	2	0	0	1	0
65–69.....	2	2	2	2	0	0	0	0
70–74.....	2	1	1	0	1	1	0	0
75–79.....	1	1	0	0	0	0	1	1
80–84.....	2	0	1	0	1	0	0	0
85–89.....	1	0	0	0	1	0	0	0
Totals.....	15	13	7	7	5	3	3	3

The starting point for the classical studies of infectious disease usually has been an identifiable clinical reaction. At first we search for the agent or, if it is known, the demonstration of its characteristics and mode of transmission. Later, we try to determine host, parasite, and environmental factors governing the incidence and prevalence of the disease.

However, man is resistant and resilient. He can withstand and adapt to stresses and insults. This ability differs with age, sex, race, nutritional state, and other variables, but man's reactions are frequently subclinical, nebulous, or transitory. This is particularly true of exposures to toxic materials in the low levels found in community air contamination.

Accordingly, some workers believe air contaminants in low concentrations will never be demonstrated as the primary cause of disease but can be evaluated only as possible contributing factors. The epidemiologist learns early to accept the concept of disease as a summation of a complex of host, agent, and environmental factors. However, the community and industry insist upon exact quantification of single variables, particularly in pollution problems.

Past and present attempts to apply epidemiological techniques to air pollution studies have been elementary and limited in scope. These attempts have dealt with persons in respiratory contact with a complex of materials in widely varying degrees of duration and concentration. The objective usually has been to relate all illnesses having any possible relationship to these exposures, however slight. This goal has been forced upon the investigators because they must work without a definite clinical reaction, specific or nonspecific, associated with such exposures. Accordingly, their findings are received and interpreted with enthusiasm or with doubt, depending upon the desires and motives of their audience.

Today, communities require the extension and refinement of epidemiological observations by carefully comparing selected components of a population exposed to accurately described environmental conditions. The proper selection of indexes, therefore, is all-important. The difficulties encountered in the use of morbidity and mortality rates for the common

respiratory and cardiac diseases are well known.

Still, the average duration of upper respiratory diseases or asthmatic attacks, the mortality rate of individuals with cardiac or pulmonary lesions, and similar measurements may deserve investigation. Whether they will serve or not will require many careful trials. At the moment, no entirely satisfactory study has ever been designed, and it is generally accepted that the search for methods to measure objectively human reactions to air contaminants must continue.

Such studies are not entered into lightly. The goal, essentially, is to relate the incidence, severity, and outcome of a group of clinical reactions, which may have a variety of etiological agents, to the presence or absence of a combination of air pollutants which may vary, absolutely or relatively, from time to time. Since precise morbidity surveys are costly and difficult, and the objectives are so illusory, few have been attempted. None thus far have succeeded in relating human disease unequivocally to differences in air pollution.

### **Preliminary Planning and Observations**

Recognizing the limitations of analytical observations, a project to determine the feasibility of morbidity surveys was planned. The primary objective was to determine if practical investigations could be designed to permit reasonably accurate descriptions of the incidence, prevalence, and prognosis of disease in a population exposed to varying concentrations of air contaminants under urban conditions.

A field team, working under the close supervision of a competent advisory committee, was formed to conduct appropriate trials and test procedures and to appraise possible indexes. It seemed desirable and requisite to explore carefully all the various approaches before planning or embarking on a large-scale investigation.

One reason for this attitude was the considerable doubt of the validity of characterizing atmospheric pollution as high or low. The extreme variability of measurements and the significant overlapping of the observations have long been recognized. It seemed essential,

ometer. For this investigation, we believe that a single interval will be sufficient but the most informative of the three will be chosen after preliminary trials with each subject.

*Oximeter.* In spite of many known sources of inaccuracy, the oximeter test of blood oxygenation has proved useful for following the progress of patients if cross-checked by simultaneous arterial puncture and gas analysis. In this study where variability from time to time was all-important and the other errors were not critical, it offered the advantage of being independent of patient cooperation, but the value of the observations is questionable.

*Respiration.* The maximum inspiratory and expiratory pressure test, not yet adequately evaluated, was included because of the rapidity and ease of use in the patient's home. It furnished some information on the relative contribution of viscous and elastic components of the lung to the total resistance and served as an index of patient variation.

### *Measurement of the Environment*

*Pollutants.* We selected the American Iron and Steel Institute (AISI) automatic smoke sampler to estimate the concentration of air contaminants. This device gives an indication of the atmospheric concentration of "smoke" by aspirating air through white filter paper. Transmission of light through the spots obtained was used as a crude index of the amount of pollution in the patients' environment.

*Temperature and humidity.* Temperature and humidity were recorded by an 8-day automatic thermohygrograph. The temperature was obtained by a bimetallic unit and the humidity by a bundle of human hairs, each operating individual recording pens. These instruments were checked at weekly intervals by more accurate psychrometers and readjusted if necessary.

*Location and servicing.* Since the protocol required that the patient's environment be continuously sampled, these mechanisms were enclosed in a soundproof box, placed in or near the bedroom. Although the noise level was not great, the need to protect the instruments and to insure the patient against the possible irritation induced by the constant hum and periodic clicks, forced the development of an elabo-

rate cabinet. It also seemed wise to fuse all circuits to avoid damage to the home or instrument wiring. The nurses checked and serviced the devices at each visit. The machines recorded for a week.

*Other measurements.* Although smoke was chosen as a crude index of the pollution faced by the patient, it is not to be inferred that it is the only, or even the principal, injurious component. Four Wilson sequence samplers were obtained to ascertain the extent of correlation between  $\text{SO}_2$  (or total acid) and the concentration of smoke. This is a satisfactory instrument, but it is not entirely suitable for home installation because of the noise of the pump and the need for daily servicing. Therefore, they were used only in carefully selected locations. There was reason to assume that, except in the neighborhood of a major effluent, the levels of smoke and  $\text{SO}_2$  would correlate reasonably well in Cincinnati.

The observations were adjusted to the community measurements of the United States Weather Bureau, the Cincinnati bureau of smoke inspection, and the Public Health Service Robert A. Taft Sanitary Engineering Center. High volume samples were obtained at five points. There were 20 dustfall stations and 3 smoke samplers in regular operation. These records of the external air in Cincinnati were correlated with the household observations.

### *Statistical Analysis*

The technique of multiple linear regression will be used to evaluate the results. A separate regression analysis will be performed for each of the pulmonary function tests and for certain groupings of the subjective symptoms. We assumed that the value of each of these tests and symptoms can be represented by a model of the form

$$Y_i = B_0 + B_1 X_1 + B_2 X_2 + \dots + B_{47} X_{47} + E_i$$

where  $Y_i$  is the  $i$ th observation of one of the tests or symptoms; and  $X$ 's are certain reduced variates identifying lapse of time, patient, and environmental conditions at the time of measuring  $Y$ , or during the preceding week; and  $E_i$  is the observational error. The effect of time will be removed by a second order polynomial; the effect of absolute differences in patient's

approach, the methodology for further studies could be arranged readily. A failure to show an association with these precise measurements would have a greater significance.

### *Patient Selection and Followup*

Twenty-eight persons were recruited through out-patient departments, private physicians, and institutions for the aged (table). This was the smallest sample expected to supply definitive results. Twice as many would have been better. However, in addition to limitations imposed by the cost of instruments, serious difficulties were encountered in recruiting the proper type of cooperative patient who lived in a significantly polluted area.

Practical considerations required modification of the original criteria. One patient was hospitalized almost immediately, and it was necessary for various reasons to drop four more patients and to select others. Changes of this nature were required throughout the trial. Forty patients were followed for varying periods. Immobilization of the patient in the home became more important, not only because the measurement of atmospheric pollution was most specific there, but also because failure to contact the patient at the proper time upset the statistical plan and increased the work of the staff of visiting nurses.

The lung function tests employed were better adapted to following the progress of chest than of cardiac patients. However, this series contains few chest patients, although they were chosen whenever possible, because:

1. Such individuals appear to remain at work or at least spend more time outside their homes, until the disease becomes advanced and they are hospitalized.
2. They tend to reside in the less smoky areas of the town.
3. Epidemic smog incidents have indicated that cardiac patients are almost equally susceptible to atmospheric pollution.

Furthermore, tuberculous patients were deliberately avoided because the disease is frequently focal. Allergic asthmatics were likewise excluded because, ordinarily, allergens could be expected to vary independently of atmospheric pollution.

In the plan, the group was to be under obser-

vation by December 1, 1954. Unavoidable delays in assembling the equipment and the need for soundproof cabinets forced postponement until early January 1955. We hoped for the occurrence of a sufficient number of inversions to permit an appraisal of the value of this approach.

In this experimental effort, we were primarily concerned with variations in the individual patient's condition. The results do not depend upon changes in the sensitive individuals as a group from the beginning to the end of the trial period or on terminal differences between groups of patients exposed to different levels of air contamination. Thus, the weekly observations of the individual subjects are much more important than his physical condition before and after the trial period. Nevertheless, the clinical assessments were made as complete as possible.

The most important part of the pilot study was to determine and record at frequent intervals changes, however slight, in the patients' well-being. The success or failure in this effort depends largely upon such observations. The patients were asked to maintain a diary recording the occurrence or exacerbation of 12 symptoms. These were selected principally to elicit any unusual irritation of the upper respiratory tract and to record the day-by-day state of the cardiorespiratory system. Some were included to test the validity of the record.

Visiting nurses recorded the pulse, temperature, and respiratory rate, checked the diary, and noted any relevant change in the environment. To reinforce the subjective findings, they made certain objective measurements of lung function at predetermined intervals. If such epidemiological investigations of air pollution are to be pursued properly in the future, simple portable tests, readily adaptable to field requirements, must be developed. This has been given much thought, and some work has been done. Much more work is required, and we believe that this pilot study will be justified by indicating fruitful approaches to this question alone. However, the following were selected arbitrarily for objective measurements.

*Timed vital capacity.* The proportion of the total vital capacity expelled in 1, 2, or 3 seconds can be determined readily by the Guensler vital-

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level of response will be removed by the corresponding terms in the model for each patient; and relevant environmental conditions are also represented in the model. In the light of these considerations it seems reasonable to assume that the  $E_i$  will be normally and independently distributed so that the usual tests of significance can be used. This assumption, of course, can and will be checked.

The sums of squares and cross-products for the variates will be obtained by punch-card equipment, and the resulting matrix will be manipulated with aid of electronic calculation.

## Results

It is far too early to report or speculate about the observations. During the course of this initial study, an enormous number of observations were made, and the analyses, as have been indicated, will not be simple nor quickly made. Even this aspect of the project is considered essentially experimental and will require trial with various approaches.

## Study Extension and Continuation

From the experiences of the past year, it is obvious that a determined effort should be made to obtain or develop simpler and more sensitive and objective methods for the assessment of respiratory efficiency. For example, the weight of the instruments, particularly the vitalometer, is at the upper limit. Also, it is essential to find a means for measuring the diffusion component of the respiration mechanism in the patient's home. Several other techniques are available, but each must be modified to meet the peculiar requirements of field investigations.

In view of the importance of eye irritation as a symptom in certain situations, we believe it is worthwhile now to consider the development of a quantitative objective method of measuring this reaction to air contaminants. Tentative steps have been made in this direction, but apparently a great amount of careful work will be required.

Furthermore, the continuous recording of the concentrations of particles of respirable size with the AISI samplers in the patient's home,

if feasible, should be supplemented by measurement of gaseous acids. Only a brief trial of the Wilson sequence sampler was carried out in this pilot study. Also, no satisfactory method of silencing has been developed, and this defect, coupled with the need of frequent servicing, limits their use in human habitations.

## Summary

The desirability for expanding investigations dealing with the many problems of atmospheric pollution has been accepted by all. They rank among the most important challenges remaining in the field of public health today. The immediate need for safe and practical disposal of airborne wastes and for rational controls cannot be ignored by the community, its industries, or the public health agencies.

Many of the proposed solutions are controversial because the reactions of man on exposure to common air contaminants at the low concentrations customarily found have not been described unequivocally. Lacking acceptable clinical evidence either pro or con, reasonable and rational control procedures cannot be instituted. Additional and more detailed epidemiological studies relating the reactions of man to this hazard are urgently needed.

We have outlined the pilot study now in progress in Cincinnati, in which the atmospheric pollution exposure of the subjects has been measured specifically and the effects of various concentrations have been sought in those individuals most likely to show measurable changes. In the event that an association between pollution and well-being is demonstrated, the methodology for further studies can be described easily. It may even be possible to institute an alarm system based on the behavior of cardio-respiratory or other sensitive patients followed in this way. On the other hand, with the precise measurements employed, a failure should have greater significance.

This approach is only one of many; it may succeed or it may fail. However, until human disease can be shown to be related to community air pollution in an acceptable fashion, the controversies regarding the degree and kind of control for air contaminants will continue.

isopropyl oil, certain cancer-producing petroleum derivatives, and radioactive ores and gases. Significant amounts of recognized cancer-producing chemicals, moreover, have been demonstrated in the exhaust of gasoline or diesel engines and in the atmospheric pollutants of English and American cities. They are contained also in the dust of asphalted roads and in the carbon black constituting a considerable component of automobile tires. The number, variety, and amounts of cancer-producing contaminants of the general and occupational environment have grown during recent decades with the development of modern industry and the increased use of industry-related products. Numerous epidemiological observations strongly suggest that industry-related factors have played an important causal role in the rise of lung cancers in the industrialized countries of the Western World observed during the last 50 years.

### Epidemiology

The general epidemiological evidence supporting this concept is as follows: While a real, definite, and progressive rise in lung-cancer frequency has been noted since the turn of the century, this development revealed marked variations in its time of onset, in its relative degree, and its progression rate in different countries and localities. In some countries, a rise in lung cancer death rates did not become apparent until after 1930 (Denmark, Norway, Italy). In others, and particularly in highly industrialized countries (Germany, Switzerland, England), this change was demonstrable soon after 1900.

English, German, Austrian, and American observations show consistently and significantly higher lung cancer death rates for inhabitants of urban-industrialized areas than those prevailing for rural areas.

Industrial life insurance male policyholders coming from low-income groups and engaged in manufacturing, mining, transportation, and other occupations with possible and often specific respiratory health hazards were found to have lung cancer rates which were 30 to 50 percent higher than those present for general policyholders, mainly composed of white-collar workers and the self-employed.

There was not only a marked irregularity in the progression rates of lung cancer deaths and morbidity for 10 different metropolitan areas in the United States, according to surveys made in 1937 and 1947, but the annual lung cancer death progression rates in the United States were higher for 1914-30 than for 1931-44. Allowing a 20-year latent period, one would expect that the progression of the death rate in recent years would be much higher than in the early period, if cigarette smoking would represent a major causal factor in the rise of lung cancer frequency.

Considering the remarkable variations in the male-female sex ratio at different times, in different localities and different demographic groups ranging even during recent years from 1:1 to 50:1, it is most unlikely that such discrepancies and changes are attributable to fluctuations in the intensity of one single factor, such as cigarette smoking, but appear to be due to alterations in the type and extent of action of a broad spectrum of environmental carcinogenic agents affecting the members of the two sexes to different degrees. Men are for occupational and environmental reasons more intensely and consistently exposed to a variety of known environmental cancer-producing atmospheric pollutants than women.

The various lung cancer-causing agents elicit lung cancers of various structural types. No special type of lung cancer is characteristic for any special carcinogenic factor. None of the main structural types was rare at any time or has any exclusive connection with cigarette smoking.

There does not seem to exist any parallelism between the lung cancer death rate and the per capita consumption of cigarettes for different countries. In fact, the rise in lung cancer death rates parallels as closely, or even more closely, the rise in production and/or consumption rates of motor fuel, coal tar, petroleum products, and several carcinogenic metals and minerals, or the construction of asphalted roads, than that of cigarettes.

### Industry-Related Factors

Occupational and epidemiological investigations present additional circumstantial evidence



# Environmental Causes of Lung Cancer

By W. C. HUEPER, M.D.

TO BE SCIENTIFICALLY acceptable, any theory on the etiology of lung cancer must reflect a critical, balanced, and competent analysis of the entire epidemiological, medical, and experimental evidence concerning the types and environmental distribution of and contacts with all known or suspected exogenous agents incriminated in respiratory carcinogenesis for environmental, occupational, or medical reasons. It is only through such scrutiny that significant and worthwhile information may be obtained as to the relative role which the various individual respiratory carcinogens have played and are playing in the production of lung cancer. The following facts and observations form an important and integral part of such an assessment.

A large amount of factual and circumstantial evidence of epidemiological, clinical, pathological, and experimental types incriminates a number of general environmental and specific occupational air pollutants in the causation of cancer of the lung. Exposure to these agents exists for considerable parts of the population in general as well as for large groups of industrial workers. Epidemiological observations on hand indicate that only a part of the environmental agents which may cause lung cancer are

known. However, an appreciable number of them have been identified, such as dusts and fumes of nickel, chromium compounds, arsenicals, asbestos, coal tar, soot, vapors or mists of



Public Health

MONOGRAPH

No. 36

The accompanying article discusses the principal findings presented in Public Health Monograph No. 36, published concurrently with this issue of Public Health Reports. The author is head of the Environmental Cancer Section of the National Cancer Institute, National Institutes of Health, Public Health Service.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

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Hueper, W. C.: A quest into the environmental causes of cancer of the lung. Public Health Monograph No. 36 (Public Health Service Publication No. 452). 54 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1955. Price 45 cents.

*Dr. Hueper is head of the Environmental Cancer Section of the National Cancer Institute, Public Health Service, chairman of the Cancer Prevention Committee of the International Union Against Cancer, and a past president of the American Society for the Study of Arteriosclerosis. He is the author of more than 200 publications on environmental cancer and related subjects, including the book "Occupational Tumors and Allied Diseases," published in 1942.*

the lips and oral mucosa are constantly bathed in the tarry liquor oozing from the tip of the cigarettes and despite the contact of these parts with the smoke coming from the cigarettes, there is no statistical association with cancer of these parts.

The claim that no tarry material exudes from the cigarette tip cannot be taken seriously, considering the well-known fact that chronic cigarette smokers have notoriously dark-brown-stained fingers. There is, on the other hand, not a single case of cancer of the fingers attributable to cigarette tar available, which would form the equivalent to the numerous cases of coal tar cancers of the hands placed on record. Such a lack of confirmatory medical evidence cannot conveniently be disposed of by assuming a specific "immunity of the skin of the first three fingers" to tobacco tar.

The claimed absence of a positive association between lung cancer and the habit of inhaling cigarette smoke also is inconsistent with the rule that the incidence rate of occupational cancers increases with the intensity of exposure to a carcinogen. The medical considerations on cigarette-smoke cancer of the lung thus reveal a number of serious and fundamental defects and contradictions.

### **Carcinogenicity of Industrial Agents**

Experimental investigations have furnished ample proof of the carcinogenicity of many of the agents involved in the production of human respiratory cancer of occupational origin.

Such an experimental evidence is available for coal tar, pitch, soot, various mineral and petroleum oils, nickel, and radioactive substances. For the carcinogenic action of constituents of coal tar there exists for instance, a large mass of experimental observations made on various species, such as mice, rats, rabbits, dogs, and chickens. Specific carcinogenic polycyclic hydrocarbons, moreover, have been isolated from coal tar and pitch, soot, mineral oils, and carbon black, and such findings have been confirmed by various investigators.

The experimental evidence concerning a carcinogenic action of tobacco tar, on the other hand, is remarkably uncertain. There exists a

considerable discrepancy in the observations made by various investigators as to its carcinogenic action on mice and rabbits. While the majority either did not find any or a very mild carcinogenic effect when tobacco tar was applied to the skin of mice or rabbits, two groups of investigators reported remarkable results in this respect. It is rather disconcerting that the latest of these reports made only a year ago could not be confirmed by subsequent investigators using a similar technique and time of application of the tobacco tar to the skin of mice.

The best that can be said about the experimental evidence on hand regarding carcinogenic properties of tobacco tar is that it indicates the presence of mildly carcinogenic agents in cigarette tar through the use of hyper-reactive animals. There is no evidence that these observations of the skin of a strain of selectively inbred mice have any equivalent in man. Thus the practical importance of these observations as to cancer of the human lung is at present uncertain.

### **Conclusions**

1. The total epidemiological, clinical, pathological, and experimental evidence on hand clearly indicates that not a single one but several if not numerous atmospheric pollutants are to a great part responsible for the causation of lung cancer.

2. The available data do not permit any definite statements as to the relative importance of the various recognized respiratory carcinogens in the production of cancers in the general population. Additive, cumulative, and synergistic effects of several of such agents are a distinct possibility.

3. Observations on occupational respiratory cancers, on the other hand, indicate that in restricted occupational groups exposed to well-defined and highly potent respiratory carcinogens all or most of the respiratory cancers found are attributable to one single carcinogenic air pollutant.

4. The widespread presence of industry-related atmospheric pollutants of recognized carcinogenic properties suggests that the recent alarming rise in lung cancer frequency espe-

in support of industry-related factors as important causal agents in the production of lung cancer.

An analysis of lung cancer frequency among members of seven large industrial groups lists nonferrous metal workers with the highest rate, followed by transportation workers, while farm laborers have the lowest rate. Other investigations indicate that workers exposed to soot from coal- or oil-burning furnaces or powerplants, to metal fumes and dusts or arsenicals, have excessive lung cancer death rates. Included in these occupational groups are operating railroad workers, engineers, stokers, chimney-sweeps, oilers, furnacemen, mechanics, welders, polishers, patent fuel workers, marine engineers, wipers, foundry workers, gashouse workers, tar workers, road workers and asphalters, sheet-metal workers, boilermakers, crane operators, smelter workers, molders, boiler scalers, lathe workers, iron ore miners, grain dockers. Since the total number of members of such occupational groups is considerable, it cannot be maintained that occupational cancer hazards account for only an insignificant portion of the total lung cancer deaths. It is, moreover, evident that abnormal occupational lung cancer hazards seem to exist only for certain groups of workers and that for this reason they must be related to exposures to definite, specific, and identifiable substances. There is scarcely any likelihood that such occupational differences in lung cancer liability are attributable to fundamental differences in cigarette smoking habits between members of the various occupational groups.

### **Occupational Groups**

Occupational cancers of the respiratory organs (lung, larynx, nasal cavity, and nasal sinuses) provide conclusive evidence of the existence of industry- and occupation-related respiratory cancer hazards for members of well-defined worker groups having contact with specific agents.

Such respiratory cancer hazards have been demonstrated for retort workers of gas manufacturing plants and coke ovens, for workers employed in crude paraffin oil pressing operations, for isopropanol manufacturers, for nickel refinery workers, chromate manufacturers and

chrome pigment handlers, for arsenical insecticide producers and users, for asbestos workers, and radioactive ore miners. The lung cancer attack rates for members of these occupational groups are many times those found for the general population of same age and sex. While the great majority of the victims of occupational respiratory cancer are males, because only males are employed in most of these hazardous occupations, whenever females also were employed, such as in the asbestos industry, and have the same type and a similar degree of exposure, there is a trend toward an equalization of the lung cancer attack rates for the two sexes.

Exposures to occupational respiratory cancer-producing agents are sometimes characterized by a typical symptom complex involving not only the respiratory organs but also other tissues and organ systems. The symptom complex related to coal tar cancer provides a striking illustration of the value of this type of medical evidence in support of a specific etiology of a lung cancer.

Medical evidence amply attests to the fact that contact of the skin with coal tar pitch, asphalt, soot, creosote, and tar oils has been responsible for several thousand cases of occupational cancer of the skin, scrotum, and lip. There are, moreover, important cutaneous stigmata characteristic of occupational contacts with these products. These manifestations form a well-defined symptomatic coal tar cancer pattern consisting of chronic dermatitis, comedones, folliculitis, hyperpigmentations of the skin, leukoderma, cutaneous atrophies, warts, papillomas, cornified horns, and light hypersensitivity. Since respiratory exposure to coal tar fumes always entails also cutaneous contact with this material, pathological symptoms from both the cutaneous and respiratory systems combine in the composition of the symptom complex elicited by exposure to coal tar and related problems.

In my opinion, the medical evidence supporting a major role of cigarette smoking in the causation of lung cancer, on the other hand, is inadequate. It is surprising to note the absence of positive statistical associations between lung cancer and cigarette cough, although this latter symptom is clinically characteristic of chronic chain smokers. Despite the fact that

# Epidemic Outbreak of Poliomyelitis in Puerto Rico

By JUAN A. PONS, M.D.

SINCE the establishment of poliomyelitis as a clinical entity in Puerto Rico in 1928, sporadic cases have been reported each year uniformly throughout the island, without significant concentration of cases, except for the years 1942 and 1946, when the disease assumed epidemic proportions, with 117 and 307 cases, respectively. An annual average of 50 cases has been recorded during the last 10-year period. A total of 31 cases with 4 deaths, uniformly distributed among 18 municipalities, was reported during the year 1953. In 1954, considerable poliomyelitis was present in Trinidad, Haiti, and Jamaica, and the epidemic in Puerto Rico was probably part of the larger situation throughout the West Indies.

Data collected by the bureau of transmissible diseases control and by the bureau of crippled children of the Puerto Rico Department of Health have been combined and used in the preparation of this preliminary report of an epidemic of poliomyelitis in Puerto Rico.

During the year 1954, up to the end of the month of October, only 21 cases of poliomyelitis, with no deaths, had been recorded for Puerto Rico. Then, in November, a sudden upsurge in the incidence of the disease took place in the municipality of Toa Baja, which has a total rural population of 13,937 (1950 census). During a period of a little more than 1 month, 27 cases, including 4 deaths, occurred

in rapid succession in a semirural area of 7,000 inhabitants, and the epidemic soon spread to the surrounding territory. Forty cases, with 5 deaths, all among residents of rural areas, occurred in the entire municipality, an attack rate of 287 cases per 100,000 rural population.

The epidemic was soon felt in adjacent municipalities and in the relatively distant municipality of Arecibo, as follows:

<i>Municipality</i>	<i>Total cases</i>	<i>Deaths</i>
Bayamon.....	30	3
Catano.....	31	4
Toa Alta.....	6	1
Rio Piedras.....	14	0
San Juan.....	21	1
Trujillo Alto.....	5	0
Juncos.....	4	0
Arecibo.....	22	1
Total.....	134	10

The epidemic form of the disease appeared in these municipalities in a chronological order that bore a close relation to their distance from the first center of dissemination. Scattered cases, which showed no tendency to epidemic concentration, have occurred in various other municipalities, to bring the total poliomyelitis cases for Puerto Rico during the 3-month period November 1, 1954-January 31, 1955, to 218 cases, including 16 deaths.

Besides its characteristic clinical manifestation, the disease has been confirmed by autopsy findings and by isolation of the virus. Through the cooperation of the United States Army Tropical Research Medical Laboratory at San Juan, P. R., type I (Brunhilde) virus has been

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*Dr. Pons is secretary of health, Puerto Rico Department of Health, San Juan, P. R.*

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cially among males may in part be causally related to the local and general development of modern industry and the use of its products.

5. While it is possible that cigarette smoking has played a contributory role in this respect, the total evidence available if critically evaluated does not favor the concept that cigarette smoking represents a major factor.

6. Since extensive and expensive efforts are required for obtaining an effective preventive control of the existing respiratory cancer hazards, rigid measures should be taken to discourage the introduction of new atmospheric air pollutants of carcinogenic type, especially if they are of the general environmental variety which are most difficult to control.

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## *An Important Date*



Each month your health department and many hospitals, laboratories, schools, clinics, and homes receive a copy of PUBLIC HEALTH REPORTS, mailed to arrive on the 20th, or even earlier, depending upon geographic location of the subscriber.

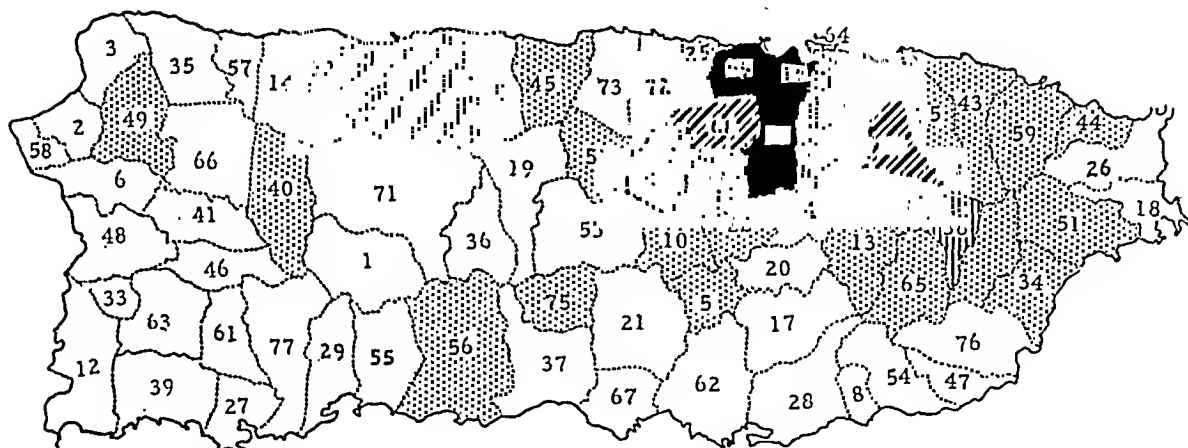
Its pages carry timely research reports, analyses of current trends, new methods, concepts, and ideas, and topical reviews for the busy scientist, teacher, or public health worker. Capsule coverage of important public health meetings, like those of the American Public Health Association, help the PHR reader.

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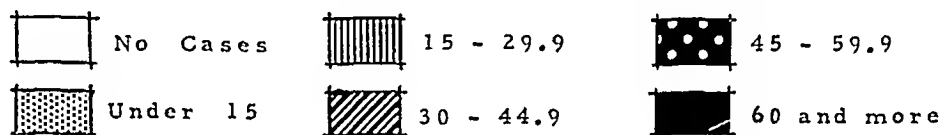
### *Scheduled for early publication*

APHA Conference Report  
Health Services in Civil Defense  
Clues To Suicide  
Encephalitis and Mosquitoes in Texas  
Refuse Handling in the United States

**Distribution of poliomyelitis cases in Puerto Rico, by municipalities, during the 3-month period  
November 1, 1954–January 31, 1955**



Number of Cases Per 100,000 Population



of age distribution characterizing tropical epidemic poliomyelitis. Five percent of the cases occurred in children under 6 months of age, and practically 90 percent belong to the age group

under 5 years, with especially marked concentration in children under 2 years of age (68 percent). Only 6 cases, or less than 3 percent, occurred in persons aged 10 years and over.

**Table 4. Confirmed cases of poliomyelitis in Puerto Rico during the 3-month period Nov. 1, 1954–Jan. 31, 1955, according to severity of involvement**

Severity	Cases	
	Number	Percent
Total.....	218	100.0
Severe <sup>1</sup> .....	103	47.2
Mild <sup>2</sup> .....	71	32.6
Cured <sup>3</sup> .....	18	8.3
Died <sup>4</sup> .....	16	7.3
Not specified <sup>5</sup> .....	10	4.6

<sup>1</sup> Involvement of one or more extremities, with paralytic manifestations. <sup>2</sup> Absence of paralysis. Muscular debility of one or more groups of muscles only. <sup>3</sup> No residual paralysis or muscular weakness. Includes abortive and spontaneous complete recoveries. <sup>4</sup> Severe cases terminating in death. <sup>5</sup> Data not available. Mostly cases treated at home by private physicians.

Table 4 shows the classification of cases according to the severity of involvement, based on preliminary evaluation at the termination of the acute stage of the disease.

Aiming at uniformity of classification of cases according to severity of involvement, after due consideration and discussion by pediatricians and orthopedic surgeons, the following classification was selected: severe, mild, cured, died, and not specified. The number of cases in each of these groups (table 4) is summarized below, according to whether the cases were paralytic or nonparalytic.

Severity	Number	Percent
Paralytic.....	<sup>1</sup> 119	54.5
Nonparalytic.....	<sup>2</sup> 89	40.9
Not specified.....	10	4.6

<sup>1</sup> 103 cases; 16 deaths. <sup>2</sup> 71 mild; 18 abortive.

From the very beginning of the outbreak, control measures were taken. These consisted

**Table 1. Municipalities in Puerto Rico in which poliomyelitis was recorded during the period Nov. 1, 1954-Jan. 31, 1955**

Municipality	Population	Number of cases	Rate per 100,000 inhabitants	Municipality	Population	Number of cases	Rate per 100,000 inhabitants
Aibonito (5)-----	18,191	1	5.5	Luquillo (41)-----	9,967	1	10.0
Arecibo (7)-----	75,361	22	29.2	Manatí (45)-----	30,449	2	6.6
Barranquitas (10)-----	17,605	1	5.7	Moca (49)-----	21,614	1	4.6
Bayamón (11)-----	48,000	30	62.5	Morovis (50)-----	19,291	1	5.2
Caguas (13)-----	60,132	2	3.3	Nagualbo (51)-----	21,019	2	9.5
Carolina (15)-----	29,224	1	3.4	Naranjito (52)-----	15,927	3	18.8
Cataño (16)-----	19,865	31	156.0	Ponce (56)-----	126,810	1	.8
Comerio (22)-----	17,966	1	5.6	Río Grande (59)-----	16,651	1	6.0
Corozal (23)-----	23,087	4	17.3	Río Piedras (60)-----	143,989	14	9.7
Dorado (25)-----	11,749	1	8.5	San Juan (61)-----	224,767	21	9.3
Guaynabo (30)-----	29,120	5	17.2	San Lorenzo (65)-----	29,248	1	3.4
Gurabo (31)-----	16,395	2	12.2	Toa Alta (68)-----	14,155	6	42.4
Hatillo (32)-----	20,877	3	14.4	Toa Baja (69)-----	15,761	40	253.8
Humacao (34)-----	34,853	3	8.6	Trujillo Alto (70)-----	13,605	5	36.8
Juncos (38)-----	21,654	5	23.1	Villalba (75)-----	14,972	1	6.7
Lares (40)-----	29,051	2	6.7				
Las Piedras (42)-----	16,208	1	6.2	Total-----	1,233,218	218	17.7
Lolza (43)-----	24,755	3	12.1				

NOTE: Figures in parentheses refer to key number of municipality (see map).

isolated in two different specimens of brain tissue collected at autopsies.

Table 1 shows, by municipalities, the distribution of cases of poliomyelitis in Puerto Rico and the corresponding incidence rate per 100,000 population during the 3-month period of the study. The incidence rate is more graphically expressed in the accompanying map. The chart shows the weekly distribution of cases throughout the year 1954 and the first weeks of 1955.

The urban and rural distribution of cases

**Table 2. Urban and rural distribution of cases of poliomyelitis and corresponding distribution of the general population exposed, Nov. 1, 1954-Jan. 31, 1955**

Residence	Cases		Population <sup>1</sup> exposed	
	Number	Percent	Number	Percent
Total-----	218	100.0	1,074,475	100.0
Urban-----	115	52.8	571,699	53.2
Rural-----	103	47.2	502,776	46.8

<sup>1</sup> 1950 census.

**Table 3. Confirmed cases of poliomyelitis in Puerto Rico recorded during the 3-month period Nov. 1, 1954-Jan. 31, 1955, according to age and sex**

Age groups	Sex			Percent in each age group	Cumulative percentage
	Male	Female	Total		
Total-----	120	98	218	100.0	-----
Under 6 months---	6	5	11	5.0	5.0
6-12 months-----	17	12	29	13.3	18.3
1-2 years-----	60	47	107	49.1	67.4
3-4 years-----	20	24	44	20.2	87.6
5-9 years-----	12	9	21	9.6	97.2
10 years and over--	5	1	6	2.8	100.0

and the corresponding composition of the general population exposed is shown in table 2. The distribution of cases corresponds almost exactly to the urban-rural distribution of the exposed population.

Table 3 shows the age and sex distribution of cases recorded during the period November 1, 1954-January 31, 1955. This age distribution is remarkably similar to the age distribution during the previous epidemics in 1942 (1) and 1946 (2) and follows closely the usual pattern

# Epidemiology of Leukemia

By GILCIN F. MEADORS, M.D.

**M**OST definitions of leukemia incorporate the concept that it is an "invariably fatal systemic disease of unknown etiology primarily involving the blood forming organs . . . characterized by widespread, rapid, and disorderly proliferation of the leukocytes and their precursors and by the presence, almost without exception, at some time during the course of the disease, of immature leukocytes in the blood often in very large numbers" (1).

Leukemia is a rare disease, but because of its fatal character it exceeds as a cause of death many of the acute communicable diseases such as diphtheria, smallpox, and poliomyelitis. In 1950, it was the stated cause of 8,845 deaths out of a total of 210,723 deaths from cancer and 1,452,454 deaths from all causes. The unknown nature of its causation, the fact that it occurs most frequently in the acute form in childhood, and its invariably fatal outcome contribute to making leukemia a matter of interest and concern to the layman and a challenge to the scientist, the clinician, and the epidemiologist some-

what out of proportion to its position in the list of causes of death.

## Clinical Characteristics

Leukemia occurs at all ages. It has been reported as present at birth (2) or as diagnosed during the neonatal period (3), and it has been recorded in one woman who was 102 years old (4). It may be fatal in a few weeks, as far as the clinical course is concerned, yet one patient was observed for 29 years with the disease in its chronic form (5).

Morphologically, leukemia is classified as myeloid, lymphoid, or monocytic, according to the type of leukocyte or precursor involved. It is further grouped into acute and subacute, or chronic, types, according to the relative frequency of the immature or blast forms appearing in the bone marrow or blood. The percentage of patients with an unclassified cell type of acute leukemia varies from hospital to hospital and ranges from nearly zero to 40 percent or more. Aleukemic forms of the disease, with normal or depressed total leukocyte counts in the circulating blood, have been described for most cell types.

Leukemia is related to other lymphomas, such as lymphosarcoma, which occasionally may first become manifest clinically as leukemia or which may have a transient or terminal leukemic phase (2). Leukemia also occurs terminally in 20 to 30 percent of the patients with polycythemia vera. Hemorrhage, anemia,

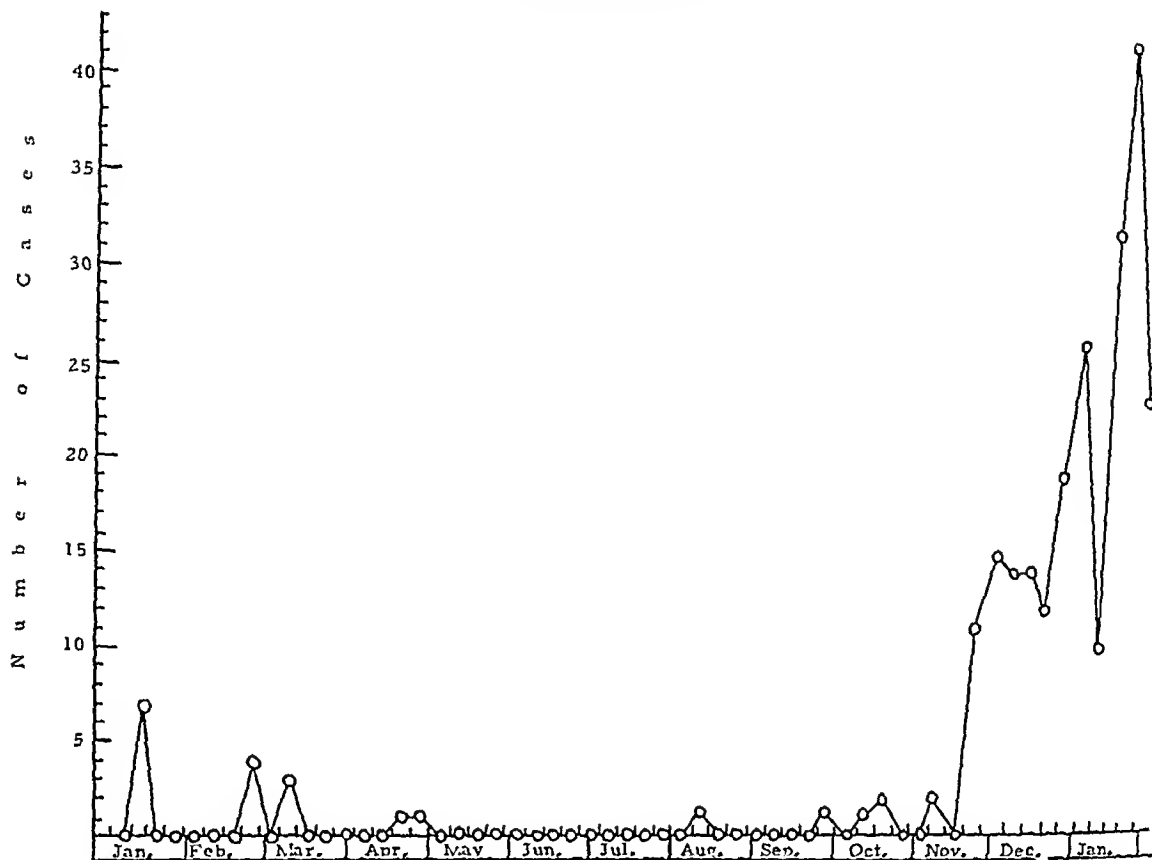
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*Dr. Meadors, now a private practitioner in Damascus, Md., was formerly chief of the Technical Services Branch of the National Cancer Institute, National Institutes of Health, Public Health Service. This is a revision of a paper presented before the Public Health Cancer Association at the 81st Annual Meeting of the American Public Health Association in New York, November 9, 1953.*

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Weekly number of confirmed cases of poliomyelitis in Puerto Rico during the calendar year 1954 and January 1955



chiefly in encouraging early diagnosis, with competent free consultation services at all times to private physicians by pediatricians and orthopedic surgeons of the department of health; prompt hospitalization in our district hospitals of suspicious or confirmed cases during the acute stage for observation, confirmation of diagnosis, and proper treatment, with subsequent followup treatment of residual paralysis or muscular weakness at the termination of the acute stage in a convalescent hospital with specially trained personnel and without limitation of hospitalization period required by each individual case; and followup observation of home cases in our diagnostic and plastic clinics.

Gamma globulin has been administered to familial and other intimate contacts under 10 years of age of known poliomyelitis cases, and general instructions frequently have been given to the public through the daily press and radio programs.

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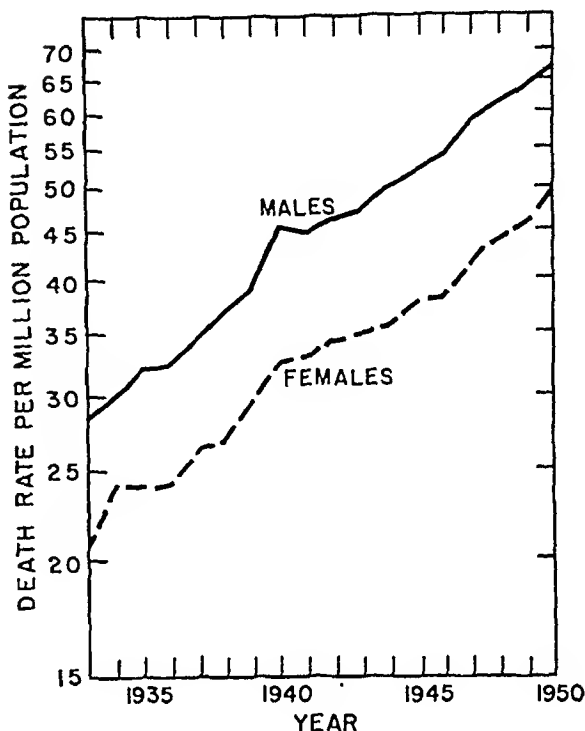
registration area, prior to 1933, did not include all of the States and the District of Columbia. The mortality rate has increased during nearly every one of those 18 years, and the rate of increase has remained nearly constant for the entire period. In 1950, the rate for all males was 67.4 and for females 49.8 per 1 million.

The question as to whether this observed increase is "real," that is, whether the risk of an individual developing leukemia is increasing or whether the risk is only "apparently" increasing, is the subject of considerable discussion. It is agreed that a portion of the increase is apparent and due to the changing composition of the population, with a relative increase in the numbers and proportion of older individuals who are known to have an increased risk for developing leukemia. This part of the apparent increase in rate may be estimated and an adjustment of rates made. Another part of the apparent increase is generally attributed to increased, improved, and more frequently used diagnostic services for leukemia, and to more public and professional interest in the disease. The influence of the latter factors has not been evaluated numerically, except for exceedingly crude estimation. And the amount of increase is dependent, to a great degree, on the convictions of the observer. Thus, when the question is restated, "Would you estimate that improved medical care and public and professional interest account for much or little of the increase in mortality from leukemia?" it is obvious that either less equivocal evidence or a direct method for estimating the real increase is required.

#### Age, Race, and Sex Selection at Death

Gilliam (6) has recently published an analysis of leukemia deaths by age, race, and sex, based on United States mortality experience during 1949. He showed that the risk of death from lymphatic leukemia was higher during each of the first two decades of life than during the third and fourth decades combined. From the fifth decade on there is a marked increase of risk with longevity. The risk of death from myelocytic leukemia is less than that from lymphatic, and there is no secondary peak in risk during childhood. The risk of death

Figure 1. Annual death rate per million population for all forms of leukemia, by sex, United States, 1933-50.



from all forms of leukemia is higher for males than for females in both white and nonwhite races, the male to female ratio being 1.5 for each race. The ratio of white to nonwhite death rates for all forms of leukemia is 2.0 for males and 2.3 for females.

#### Urban-Rural Distribution

The reported mortality from all forms of leukemia and aleukemia during the years 1944-48 was examined for urban-rural differences in the United States. Average annual mortality rates, according to age and sex, were calculated for urban and rural residence (see table). Urban rates are almost consistently higher than corresponding rural rates for each age and sex group. In diseases for which the precision of diagnosis is dependent on more difficult or specialized procedures, this type of phenomenon is usually ascribed to the relative availability of medical care.

When these data are plotted on a semilogarithmic grid (fig. 2), a changing order of dif-

intercurrent infection and toxemia, and symptoms arising from enlargement of the liver and spleen are characteristic of the clinical disease. The rapidity of development and severity of symptoms, the number and duration of remissions, and the length of survival have classically distinguished the acute from the chronic clinical course. Degree of response to specific chemotherapeutic agents may provide an additional dimension for differentiation of subgroups.

The relative frequency of the acute and the chronic forms in both clinical and autopsy series suggests that the acute form is more common in children and youths, and the chronic form occurs more frequently in older persons. Frequency distributions from these and similar sources cannot be related to the population at risk. The apparent difference in age selection of acute leukemia, in particular, may be of a different order from that currently accepted.

### Problems of Classification

As pointed out by Gilliam (6), the classification of leukemia in the sixth revision of the International Lists of Diseases and Causes of Death (1948) is probably as detailed as is realistic for routine recording of deaths. It provides for classification of leukemia by cell type, but no distinction is made between the acute and chronic forms of these entities. Until 1910, the International List included all leukemia under the general term of "anemia." From that date Hodgkin's disease was tabulated under "leukemia" until 1921, when the two entities were given separate rubrics. Between 1938 and 1948, the two forms "leukemia" and "aleukemia" were distinguished by the International List but with no indication of cell type or chronicity.

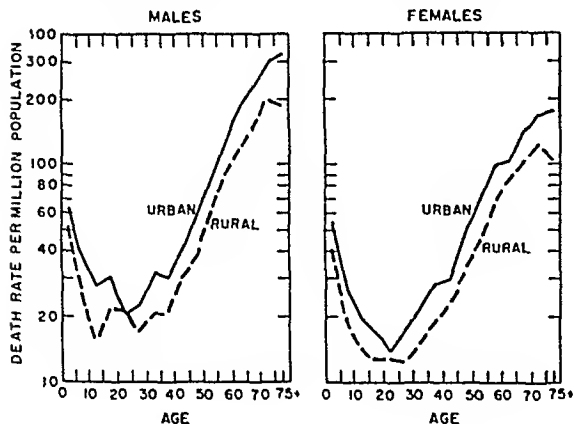
Sacks and Seeman (7) explored the sources of error in the reporting of leukemia as a cause of death. They came to the conclusion that the system of diagnosis and of classification, as established by the fifth revision of the International List (1938), led to an understatement of deaths from leukemia, but that joint cause selection had no significant effect. Congenital leukemia is known to be overlooked as a cause of neonatal death (2). Other diagnoses, which

possibly have been overlooked, are leukemia occurring in elderly patients who have died presumably from other diseases of old age and in patients of all ages who have died of a fulminating infection relating to an undiagnosed acute leukemia. This latter category has probably decreased in importance because of the effectiveness of antibiotic therapy. Beneficial results from the use of cortisone and chemotherapeutic agents in addition to radiation and blood transfusions make it likely that in the future a larger proportion of patients with leukemia, or suspected leukemia, will be hospitalized at some time during the course of their illness. Increased specificity of diagnosis can be expected and should result in more accurate death certification, followed by less under-recording of leukemia as a cause of death.

In his search for clues to the etiology of leukemia, the epidemiologist must almost perforce be dependent on records designed and assembled for other specific purposes. Sources for clues to the epidemiology of leukemia include mortality records, cancer case registers and surveys, clinical and laboratory records, and results of studies of experimental leukemia. The characteristics of leukemia as determined from these sources are at times confusing, if not contradictory, and the question may be raised as to whether "the leukemias" is not a more appropriate term than "leukemia." The acute and chronic forms of leukemia exhibit such wide differences in the clinical course, response to therapy, age selection, and micropathology that they may be considered as different entities, with some manifestations common to both.

Vital and clinical records should not be neglected as sources of leads for more detailed and specific studies despite the problems involved in diagnosis and classification of individual cases of leukemia and questions that may be raised about the adequacy of such records. The trend in mortality from leukemia, as the stated cause of death in the United States registration area, has been reviewed by Sacks and Seeman (7), who reported an increase in the crude rate from 19 per 1 million population in 1900 to 37 per 1 million in 1940. Trends in mortality rates from leukemia, according to sex, are shown in figure 1 for 1933-50. This period is used because the United States death

**Figure 2. Average annual death rate for all forms of leukemia per million white population, according to age and sex, for urban and rural residents of the United States, 1944-48.**



cedent events are reported, and the evidence, with regard to some, is mounting that they provide conditions "sufficient" to induce leukemia. Hueper (11) in his text on occupational tumors has provided the most exhaustive consideration of these factors.

### Exposure to Radiation

Wynder (12), in a discussion of the practical aspects of cancer prevention, reviewed the evidence for the relationship between the development of leukemia and prior exposure to radiation or to chemicals suspected of having leukemogenic properties. His evaluation of present knowledge of these factors was that "no good evidence was at hand" except with respect to radiation and possibly with respect to benzol. Wynder's conclusion with regard to radiation was based, in part, on analyses by March and Ulrich of the mortality among radiologists from leukemia.

For a 20-year period ending in 1948, March (13) computed ratios of deaths from leukemia to all deaths for radiologists (4.68 percent) and for nonradiologist physicians (0.51 percent). He concluded that the risk of death from leukemia among radiologists was 9 or 10 times that of nonradiologist physicians. Dublin and Spiegelman (14) compared age-adjusted death rates from leukemia for male physicians (11.4 per 100,000) to the rate for the white male population (6.5) and found a ratio of 1.75. Later

they found the number of deaths from leukemia among radiologists during 1938-42 was "several times the number expected on the basis of the mortality experience of all male physicians" (15).

Peller (16) cited age-standardized rates for mortality from cancer exclusive of leukemia and from leukemia for radiologists, all other physicians, and for all white American males of the same age. He concluded that the mortality from leukemia was 3.5 times greater for radiologists aged 35-74 than for other physicians, and 8.5 times that of all white males of similar age. These ratios are somewhat less than the estimates of March. It was his impression that part or all of the increase in the leukemia mortality took place at the expense of the total mortality from all cancer, including leukemia, though he was unable to confirm this from the data available.

The fact that all persons, with even more prolonged exposure to radiation or to chemicals, do not develop leukemia (for example, not all radiologists die of leukemia) suggests that for those who do not succumb, some condition or conditions "necessary" to leukemogenesis are not operative. It has been frequently suggested that presence or absence of a hereditary predisposition might explain some of the vagaries of the behavior of the disease in a human population, that is, that a "cancer diathesis" might be a necessary condition for leukemogenesis.

### Genetic Predisposition

Videbaek (17) published in 1947 the results of a genealogical study in Denmark of the families of 209 leukemic probands selected from 310 leukemia patients on the basis of availability of sufficient family data. The study was controlled with the families of 200 nonleukemic persons. Leukemia was found to have been diagnosed in members of 17 of the 209 families of leukemic probands (8.1 percent), and in only 1 of the 200 families of controlled nonleukemics.

Videbaek discussed genetic mechanisms which are consistent with the production of familial aggregates of disease of this order and came to the conclusion that human leukemia seemed to be generally dependent on, among other conditions, a nonspecific hereditary pre-

**Average annual mortality rates from all forms of leukemia per 1 million white population for urban and rural residents, according to age and sex, United States, 1944-48.**

Age in years	Male		Female	
	Urban	Rural	Urban	Rural
0-4	61.56	50.17	54.81	40.99
5-9	38.30	25.60	26.84	19.36
10-14	27.43	15.48	19.93	14.31
15-19	30.61	21.97	17.10	12.76
20-24	20.29	21.58	13.96	12.95
25-29	22.50	17.19	17.26	12.45
30-34	31.26	20.47	22.65	15.33
35-39	30.20	20.52	28.06	18.81
40-44	39.43	29.60	30.28	23.15
45-49	57.28	37.75	47.05	32.14
50-54	86.00	59.42	66.17	42.59
55-59	126.32	89.21	97.85	63.07
60-64	180.08	115.93	104.74	86.75
65-69	228.45	144.67	140.30	102.53
70-74	292.71	200.52	169.89	127.57
75 and over	318.93	184.13	174.39	107.14
Total	67.35	45.83	48.39	32.75

ference in rates at different ages becomes apparent. The greatest urban-rural differences in mortality rates for white males appear to be at ages 10-14 and 30-39; for white females at ages 10-19 and 25-39. The least urban-rural differences in rates for white male mortality appear to be at ages 20-24 and 0-9; for white females at ages 20-24 and 0-9. The white male experience was the largest in total number and was selected for statistical examination of the variability of urban to rural ratios. Analysis of variance techniques were applied, and the variation between age groups was significantly greater than could be accounted for by chance alone. This does not appear consistent with the hypothesis that urban-rural differences in leukemia mortality are attributable for the most part to urban-rural variation in the availability of medical care.

Clemmesen, Busk, and Nielsen (8) examined the topographical distribution of leukemia in Denmark and published diagrams showing the trend of rates of mortality attributed to all forms of leukemia for the years 1931-45, by sex and by density of population at place of residence. Age composition was not considered. Rates for residents of rural areas tended to be lower than for residents of the capital, with

provincial towns somewhere in between. Annual fluctuations in the rates were wide, however, and the tendency in these data toward an urban-rural difference is not remarkable.

### Socioeconomic Distribution of Deaths

From rather meager published data, the higher death rates for leukemia appear to occur more commonly in the more prosperous segments of the population. The two pieces of evidence cited display quite similar trends of increase in rates from lower to higher economic status.

The older data are from the registrar general's report dealing with mortality in England and Wales during the years 1930-32 (9, 10). Decedents were classified according to recorded occupation into five classes: class I, professional; class III, skilled artisan; class V, laborers and unskilled workers; classes II and IV, intermediate and mixed types of occupations or types not readily assignable to classes on either side. Deaths of men and married women only were considered in the analysis. The men were classified according to their own occupation and the women according to the occupation of their husbands. Standard mortality ratios for leukemia deaths in each class exhibited a progressive decrease from class I to class V. This trend is directly opposite to similar ratios computed for deaths from all forms of cancer.

More recently, Sacks and Seeman (7) grouped census tract populations into eight classes according to median monthly housing rental and computed average annual death rates from all forms of leukemia for the years 1939-43. Aside from an irregularity in the trend, probably arising from the small number of cases involved, the death rates from leukemia increased with corresponding increases in average rentals.

### Other Etiological Factors

In 1938, Forkner (1) wrote that "in a minority of [human] cases some disease or incident can be found in the patient's life to which the leukemia is sequential in time, and to which, in some degree, it may be related, but in the majority of cases no such antecedent is demonstrable." Each year newly observed ante-

# Clues to Suicide

By EDWIN S. SHNEIDMAN, Ph.D.,  
and NORMAN L. FARBEROW, Ph.D.

THE IMPORTANCE of the phenomenon of suicide is gauged by the fact that more than 20,000 people take their lives each year in the United States (1). Professional psychiatric, psychological, and social services might save many potentially suicidal persons if the danger is anticipated. In our continuing study of suicide at the Veterans Administration Neuropsychiatric Hospital in Los Angeles County, Calif. (2-4), we are attempting to discover a few of the danger signals.

A basic point of view implicit in our study is that we believe suicide to be motivated by sociologic, cultural, ecologic, psychological, and many other factors (5-8). Another basic point of view is our belief that meaningful studies of

suicide can effectively use the scientific method of experimental control.

Our purpose at this time is to describe an experimental approach in the investigation of psychological factors in suicide and to report a few tentative results. Although our study is limited to the psychological aspects of suicide, it does not preclude other important aspects of the phenomenon studied by Cavan, Dublin and Bunzel, Durkheim (5-7), and others.

## Three Types of Raw Materials

Our raw materials are psychiatric case histories, psychological test results, and suicide notes. We have attempted to obtain adequate control data for each category so that statistical comparisons might be made.

## Case Histories

The names of adult male suicides were obtained from the weekly lists of all suicides in the Los Angeles County Coroner's Office for the period 1944-53. By checking the names of completed suicides with rosters of former patients of Veterans Administration neuropsychiatric hospitals in the county, we collected the psychiatric case histories of 32 adult male patients who, some time after discharge from the hospital, had killed themselves.

The case histories of the 32 suicides were then checked with the case histories of an equal number of control cases in each of 3 comparable categories of neuropsychiatric hospitalized males: a group of 32 males who had attempted

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*In its original form this paper was presented at the annual meeting of the American Association for the Advancement of Science, Berkeley, Calif., December 28, 1954.*

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disposition to cancer. He estimated that this predisposition is present in at least 20 percent of the population and is partly dependent on one or several genes which determine, to some degree, the localization of the cancer.

There was no attempt in this study of genealogies to define the "other conditions" on which the occurrence of leukemia might be dependent. And since familial aggregates of similar order have also been observed for diseases of both infectious and environmental etiology no conclusions can be drawn with reference to the relative importance of genetic factors in the production of human leukemia.

## Summary

1. Variations in age, sex, race, and socioeconomic selection of leukemia are reviewed and data on urban-rural distribution of deaths from leukemia in the United States are presented.

2. The finding that death rates from leukemia at certain ages are significantly higher in urban than rural populations of the United States, while at other ages they are of the same order, appears to be inconsistent with a hypothesis that the higher crude rates in urban population can be accounted for by superior diagnostic services in cities.

3. From the published data reviewed there is no evidence that hereditary influences or exposure to leukemogenic agents are mutually exclusive in the etiology of human leukemia nor that they may not be considered jointly as co-leukemogenic factors.

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In collecting these data we followed much the same procedure used for obtaining the case histories. The lists of suicides in Los Angeles County were checked against the hospital rosters. Then the previously administered psychological tests on individuals who had subsequently committed suicide were found. Psychological tests on comparable groups of individuals who had attempted suicide, threatened suicide, or who were nonsuicidal were obtained next, and the test results among the four groups were compared.

However, only the test results for 96 of the 128 subjects—the nonsuicidal subjects and those who attempted or threatened suicide—have been analyzed so far. Data for those persons who had been tested and who subsequently committed suicide have not yet been collected in numbers sufficiently large to be subjected to statistical analysis.

### *Suicide Notes*

For our third set of raw materials, we collected 721 genuine suicide notes with the cooperation of the Los Angeles County Coroner's Office. The notes were written during the period 1944 through 1953. Some were written by men, some by women, others by children. The writers were as young as 13 and as old as 96.

There are practical, as well as theoretical, difficulties in obtaining control data to match with genuine suicide notes. A practical difficulty is that notes written by people who have threatened or attempted suicide are hard to obtain inasmuch as they are usually destroyed. To obtain control data, we asked certain individuals, carefully matched with the genuine suicide-note writers, to write the simulated suicide note they would leave if they were going to take their own lives.

The names of the people we asked to participate were obtained from such community sources as labor unions and fraternal groups. In recognition of the moral and ethical overtones associated with suicide, we employed preliminary screening tests, interviews, and other safeguards in order to screen out anyone who might be upset by writing a fictitious suicide note.

Our last step was to analyze the genuine and

pseudosuicidal notes and to relate the statistically significant results to the major psychiatric, psychoanalytic, and psychological hypotheses about suicide.

## **Results of Research**

The following findings come from the research in process and are tentative in nature.

### *Case History Comparisons*

From our studies of the four sets of psychiatric case histories (2), we concluded:

1. It is practically impossible to distinguish a potentially suicidal person from the details of his case history alone, however stressful or traumatic it has been.

2. Seventy-five percent of the subjects who committed suicide had a history of having previously threatened or attempted suicide, although a suicide threat or gesture is not necessarily the mark of a potential suicide.

3. Almost half of the individuals who committed suicide after leaving the hospital did so within 90 days after having been discharged.

As to the first finding, there were few differences in the case history details among the four groups. For example, as many people in one group as in another were only children, came from broken homes, had a history of suicide in the family, and so forth.

From all the comparisons made of the 4 groups we found that only a diagnosis (see table) of reactive depression or paranoid schizophrenia differentiated the 3 suicidal groups (completed, threatened, and attempted suicide) from the nonsuicidal group. Only a history of mental hospitalization among members of the family distinguished the completed suicide group from the other 3 groups. All other comparisons yielded negative results.

Although it is true that not all people who have attempted or threatened suicide go on to commit suicide, the contrary fact—our second finding—is even more striking; that is, there is a large percentage of suicides, specifically 75 percent in our study, who have a history of having threatened or attempted suicide. This fact would seem to indicate that suicidal gestures (attempts or threats) may be considered as danger signals and must be taken seriously.



suicide, a group of 32 who had threatened suicide, and a group of 32 who had no suicidal tendencies. In the 4 groups selected, all 128 subjects were male, white, and most of them were from 20 to 40 years old although the ages ranged from 20 to 69.

We have analyzed the 128 case histories in terms of more than 100 different social, economic, cultural, and psychological categories, and have computed the statistical significance of the differences among the 4 groups. Samples of the categories used for analysis are: family history details, economic level, par-

ents' age at the time of various events in the subject's life, educational and vocational achievements, marital status, and psychiatric diagnosis—an example of which is presented in the accompanying table.

### *Psychological Tests*

For our second type of raw data, we collected test results on the Rorschach ink-blot technique, the Thematic Apperception Test, the Make a Picture Story test, and the Minnesota Multiphasic Personality Inventory, among others.

### **Diagnostic classifications of subjects in suicide study**

Classifications	Completed suicide	Attempted suicide	Threatened suicide	Non-suicidal
<i>Neurotic</i>				
Reactive depression.....	5	7	6	0
Hysteria.....	1	1	1	1
Anxiety reaction.....	2	2	3	5
Phobic reaction.....	0	0	1	0
Obsessive-compulsive neurosis.....	0	0	1	0
Disassociative reaction.....	0	0	0	1
Neuropsychiatric mixed and/or undetermined reaction.....	0	2	2	1
Total.....	8	12	14	8
<i>Psychotic</i>				
Schizophrenia, simple.....	0	0	0	2
Schizophrenia, hebephrenic.....	0	1	0	0
Schizophrenia, paranoid.....	9	6	6	3
Schizophrenia, catatonic.....	1	0	0	1
Schizophrenia, unclassified.....	0	1	0	4
Schizophrenia, mixed.....	1	1	4	2
Manic-depressive psychosis, manic.....	1	0	0	0
Manic-depressive psychosis, depressed.....	2	0	2	0
Psychotic depression.....	0	1	0	0
Paranoid state.....	0	0	0	1
Involitional melancholia.....	1	0	0	0
Total.....	15	10	12	13
<i>Organic</i>				
Epilepsy, grand mal.....	0	0	0	0
Epilepsy, petit mal.....	0	0	0	1
Epilepsy, idiopathic.....	1	1	0	0
Epilepsy, psychomotor equivalent.....	0	1	0	0
Traumatic encephalopathy.....	0	1	1	0
Paresis.....	0	0	0	1
Total.....	1	3	1	2
<i>Miscellaneous</i>				
Passive dependency.....	1	2	0	2
Emotional instability.....	0	2	1	1
Inadequate personality.....	0	1	0	1
Character disturbance.....	0	0	0	1
Psychopathy.....	0	0	1	0
Alcoholism.....	7	1	3	4
Schizoid personality.....	0	1	0	0
Total.....	8	7	5	9
Grand total.....	32	32	32	32

What might our findings indicate about suicide-note writers?

We interpreted the higher percentage of neutral thoughts expressed by the genuine-note writers to indicate two important, although quite contradictory, feelings on their part and, in addition, to reflect a basic difference in the attitudes of the two groups of writers.

The genuine-note writer has apparently accepted and incorporated the idea that within a short time he will not be alive. He therefore instructs and admonishes in relation to the many details of continued living which he will not be able to pursue himself.

The fictitious-note writer, although he can apparently fantasy the "affect" of suicide, inasmuch as the number of relief statements and discomfort statements are proportionately the same, does not take that additional step of converting his fantasy into the "reality" of imminent absence.

In other words, only the genuine suicide-note writer can fantasy his really being gone. At the same time, there is a distinct contradiction between his decision to die and his listing of things to do and his plans for the future. It is as though he were exercising power and command in these directions, as if he somehow were making sure his plans would be carried out. It is a kind of unrealistic feeling of omnipotence and omnipresence on the part of the suicidal individual which may reflect in part some of the confused, illogical, and paradoxical motivations in the entire act.

We noted that the discomfort statements in the simulated suicide notes were only mildly negative but that similar statements in the genuine notes were characterized by deeper and more intense feelings of hatred, vengeance, demand, and self-blame. As used at this time, however, the discomfort measure does not reflect these differences.

### Some Words of Caution

In addition to the fact that our project deals only with some of the psychological aspects of suicide, as revealed in case histories, psychological tests, and suicide notes, some other limitations of the study should also be made explicit.

The data we have analyzed so far are re-

stricted to a specific period (1944 to 1953) and to a specific area (southern California) and, therefore, cannot be representative of all times and all locations.

We wish to point out also that, although the 721 suicide notes in the study represent almost 100 percent of the suicide notes written in Los Angeles County during the 10-year period 1944-53, only about 15 percent of the suicides in the county have left notes. Thus, the conclusions about the psychology of suicide from this source may possibly contain some as yet undisclosed sampling biases.

Our clues about suicide are to be taken only as an interim report of tentative findings from a continuing study. We hope, within the next few years, to report more definite information about the psychological nature of suicide from which a clearer theoretical understanding of its motivations can be obtained and, perhaps, even some clues as to how its prevention and control can be evolved.

### Summary and Conclusions

The following five points are offered as a summary of the findings and implications of this interim report:

1. Three-fourths of our subjects who committed suicide had previously threatened or attempted to take their own lives. This means that suicidal behavior, whether attempted or threatened, must be taken seriously, inasmuch as the next suicidal "gesture" may be the final one.

2. Almost half of the individuals who committed suicide did so within 3 months of having passed an emotional crisis and after they seemed to be on the way to recovery. This means that physicians and relatives must be especially cautious and watchful for at least 90 days after a person who has been suicidal appears to be improving.

3. On the basis of comparisons among psychological tests, it appears that the person who threatens suicide seems to be more emotionally disturbed than the person who attempts suicide, but both must be taken seriously and watched carefully at least for 3 months.

4. The comparison of genuine suicide notes with simulated suicide notes indicates that the

The results of this study do not permit us to state whether the same percentage would apply in a general population. Nevertheless, the finding does suggest that suicidal threats and attempts are a danger signal in the type of suicidal population found in a neuropsychiatric hospital or sanatorium.

Clinical observations in the psychiatric literature corroborate the finding that almost half of the individuals who did commit suicide after leaving the hospital did so within 90 days after discharge. Thus, it appears that even though persons of observed suicidal tendencies are judged to have improved sufficiently to be ready to function in the community again, they are in a dangerous period. It is not possible to state what might be the result of keeping such patients in the hospital another 90 days without further detailed, controlled investigation.

This third finding has implications for timing discharge from treatment and for continuing vigilance in behalf of these emotionally disturbed individuals. It would seem that if a person has been making suicidal attempts or threats, his physician and relatives must be especially cautious for at least 3 months after he appears to be improving and after he seems to be on his way to recovery.

### *Psychological Test Comparisons*

Our study (3) of the psychological tests for those who attempted suicide, threatened suicide, or who were nonsuicidal resulted in the interesting finding that there are differences among individuals heretofore loosely classified as "suicidal." The people who threatened suicide seemed to be more emotionally disturbed than the people who had attempted the act.

There were some differences between people who attempt suicide and threaten suicide. Specifically, individuals who have threatened suicide show more guilt, aggression, irritability, and agitation—in a word, more disturbance—than do individuals who have attempted suicide. Those who have attempted suicide are more like the nonsuicidal mental hospital patients, except perhaps more withdrawn. It is almost as though the attempt itself had operated in an abreactive and therapeutic manner and had lessened the immediate seriousness of the personality disturbance. This temporary relief,

however, does not mean the emotional state ceding suicide will not return.

### *Genuine and Simulated Notes*

From the preliminary comparisons of genuine and simulated suicide notes (4), we are presenting only the results of our application of the Discomfort-Relief Quotient, a technique developed by Mowrer (9).

Mowrer's technique is used to measure relative amounts of discomfort thought in relief thought units, and neutral thought units contained in case history materials or in statements made during psychotherapy sessions. The thought unit is a discrete idea, regardless of number of words. The Discomfort-Relief Quotient was deemed to be applicable to analysis of genuine and simulated suicide notes for indications of the current emotional ideational state. Thirty-three male, white, Protestant, married, native-born, genuine suicide-note writers were matched man for man by age and occupation, with 33 nonsuicidal simulated-note writers.

The total number of thought units was significantly higher in the 33 real notes than the fictitious notes, indicating that the genuine note writers apparently feel the need to say more in this last communication.

With respect to the "discomfort" statements or the statements of guilt, blame, tension, aggression, and the like, we found no statistically significant difference between the proportional number of discomfort units expressed by the genuine suicide-note writers and those expressed by the simulated-note writers.

As for the number of "relief" statements, statements which were pleasant, warm, loving, and which denoted relief from tension, we found no quantitative difference between the genuine notes and the simulated notes.

It was in regard to the "neutral" statements—the statements free of expressions either of tension or of release from tension, that the notes revealed the greatest significant difference. The genuine suicide notes contained much the higher percentage of neutral thought units. On inspection, we found them to be mostly statements giving instructions and admonitions and sometimes listing things to do.

*The American Heart Association and Federal, State, and local health organizations work together to further research, community service, and education in the cardiovascular diseases.*

# Cardiovascular Diseases and Public Health

By JOHN W. FERREE, M.D., M.P.H.

- One out of every sixteen persons in the United States has some form of cardiovascular disease.

- One out of every two deaths in this country is from a disease of the heart or blood vessels.

- Approximately 176 million workdays are lost yearly because of heart disease.

- Cardiovascular diseases accounted for the major or secondary impairment in more than 42 percent of those receiving aid under the Bureau of Public Assistance of the Social Security Administration program for the permanently and totally disabled, as shown in a cross-section survey.

- Cardiovascular diseases are long-term diseases; hypertension, for example, has an average course of 20 years.

- In the general population, 3 percent of untreated streptococcal infections are followed by rheumatic fever; among those who have had rheumatic fever, the figure can be as high as 50 percent.

- A recent study of the caseload of the Instructive Visiting Nurse Association in Baltimore indicated that 46 percent of the nonmaternity cases had some disease of the heart or circulatory system as the principal diagnosis.

All these are persuasive—if coldly statistical—reasons for firmly placing the cardiovascular diseases in the public health domain. The American Heart Association has long recognized the public health implications of heart disease, and the concept of community responsibility in prevention, diagnosis, treatment, and education is basic to its philosophy.

The association regards the person with heart disease as a person with social, economic, and personal problems which bear not only on himself and his family but on the community as well. It follows that these problems lend themselves in great measure to successful attack by organized community effort, long accepted as a criterion for public health action. These cardiovascular disease problems, then, are definitely a public health responsibility.

## History

Community action to help the cardiovascular disease patient has from the start been one of the primary concerns of the American Heart Association.

The first organized effort to collect and apply information on heart disease was made by a group of New York physicians whose interest was sparked by pioneer cardiac rehabilitation work being done at Bellevue Hospital. In 1916, they formed the "ancestor" of the AHA, the Association for the Prevention and Relief of Heart Disease. Dr. Haven Emerson, then commissioner of health in New York, was a leading spirit of the movement.

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*Dr. Ferree is director of community services and education, American Heart Association, New York, N. Y. He was formerly State health commissioner of Indiana.*

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person about to take his own life includes orders and admonitions as though he had reached a final decision in solving his problems and had accepted the fact that he will soon no longer be around.

5. Calling upon professional psychiatric, psychological, and social service specialists for the treatment of a potentially suicidal person may mean the difference between life and death.

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### Special Assistant for Medical Affairs



**Dr. Lowell T. Coggeshall**, nominated by President Eisenhower to be special assistant for health and medical affairs to the Secretary of Health, Education, and Welfare, has been dean of the University of

Chicago division of biological sciences, which includes the university medical school, since 1947. In this position, he directed one of the country's largest biological and medical research centers.

He succeeds Dr. Chester S. Keefer of Boston, Mass., who resigned August 1, 1955. Until July 1, 1955, Dr. Coggeshall was also chairman of the Committee on Medical Sciences of the Department of Defense, and at present he is chairman of the Medical and Scientific Committee of the American Cancer Society.

An authority in the field of tropical medicine, Dr. Coggeshall, then a captain in the Navy, was assigned by the Army Air Force during World War II to the Pan American World

Airways in Africa, where he was responsible for establishing medical services along air routes through Africa and the Far East. Later, he was named special medical consultant to the Secretary of War, and during his tenure in that post was in charge of the Klamath, Oreg., tropical disease hospital for Navy and Marine personnel.

Dr. Coggeshall, born in Saratoga, N. Y., in 1901, received his medical degree in 1928 at the University of Indiana, where he also was awarded the degree of doctor of laws in 1948. From 1935 to 1940, he was a staff member for research in tropical diseases, international health division, of the Rockefeller Foundation. He was professor of preventive medicine of the School of Public Health, University of Michigan, from 1940 to 1941, and was chairman of the department of tropical medicine, University of Michigan Medical School, from 1942 to 1944. He then returned to the University of Chicago as head of the department of medicine.



Foxglove plant "breathing in" radioactive carbon dioxide syringed into surrounding bell jar. Radioactive digitalis will be prepared from the dried leaves for use in tracer studies.

disease. And, certainly as important, informed laymen were needed to organize and coordinate community programs all over America.

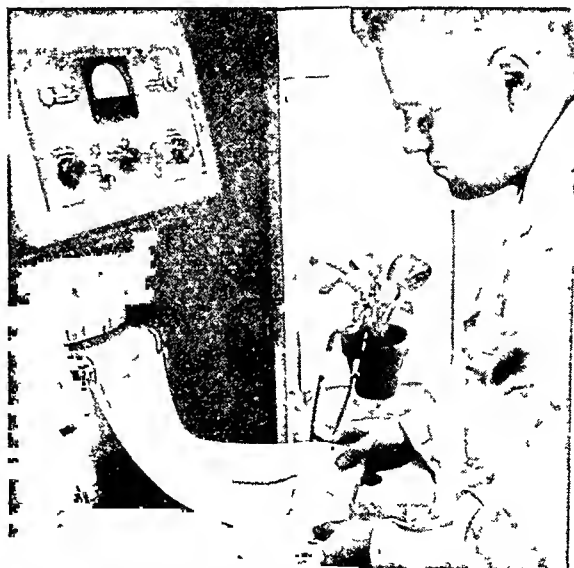
In 1948 the American Heart Association was expanded into a voluntary health agency, the only national voluntary health agency devoted exclusively to combating diseases of the heart and circulation. Laymen and professional persons not previously eligible were admitted to membership and to places on the association's governing bodies for the first time.

At present the AHA and its affiliates have a voting membership of about 25,000, almost evenly divided between physicians and laymen. There are now 56 direct affiliates and more than 350 local chapters, which are largely autonomous in developing programs to meet their own community needs. The national headquarters in New York administers the national phases of the program, maintains a clearinghouse of ideas and suggestions for the work of State and local associations and committees, and provides educational and program guidance materials and services for them.

The program activities of the American Heart Association are financed primarily by public contributions made during the annual February Heart Fund campaign. At least half of the funds received by the national office are spent to support research, which has top priority in the program as the single most important factor by which we hope to conquer or control the heart diseases.

But results of research do not automatically become full-fledged community programs for helping people with cardiovascular disease. And the encouraging news of scientific progress does not announce itself to those who should hear it. To reach them, an educational program is needed.

Guiding the association's triple program of research, community service, and education are three councils, each directly responsible to the board of directors of the association. They are the Scientific Council, the Council on Rheumatic Fever and Congenital Heart Disease, and the Council on Community Service and Education. The councils are subdivided into committees made up of specialists in their particular fields, who, through their combined experience, are able to give advice and guidance on heart programs.



"Tracer" digitalis enables researchers to follow the drug and to study its action after it enters body tissue.

One of the association's first actions was to encourage formation of cardiac clinics similar to the one at Bellevue. Soon 20 clinics were functioning in hospitals and outpatient departments.

Aside from clinic work, the young organization busied itself with fulfilling its other goals and purposes:

"To gather data from wide sources and arrange for its practical application, in education, occupation, and social welfare; to study and develop occupations and vocational guidance for cardiacs; to take a formative interest in workmen's compensation insurance and similar problems affecting cardiac patients; to work constantly for the prevention of heart disease through the dissemination of information and the application of preventive means (as in increased facilities for poststreptococcal throat and dental treatments); to organize cardiac convalescence to provide larger opportunities in existing institutions, especially for youth; to assist in coordinating the various efforts in this field as made by health departments, schools, cardiac classes, special investigators, the Trade School for Cardiacs, etc.; and to encourage the formation of branch associations."

By the early 1920's, physicians throughout the country had become interested in the association's work. Accordingly, the New York group invited about 100 physicians to a meeting in St. Louis on May 24, 1922, to plan for a national organization. Two years later, on May 20, 1924, the American Heart Association was formally incorporated under the laws of New York State.

The St. Louis meeting defined the objectives of the projected national organization as follows:

"The function of such an association would be to coordinate all activities bearing on the heart problem, to develop new lines of research, to collect and distribute information, to further public health and industrial education, and to develop a sound public opinion as to the true meaning and seriousness of the problem."

Not all of these objectives could be carried out immediately. For more than two decades, the association performed important professional functions. It published a scientific journal, held an annual 2-day scientific meeting,

and established standards in such technical matters as clinical electrocardiography and blood pressure readings.

Of particular significance were the early and continuing achievements in standardizing nomenclature and criteria for diagnosis of cardiovascular diseases. The first work in this area was done in 1916; it has been carried on by the New York Heart Association, which publishes "Nomenclature and Criteria for Diagnosis of Diseases of the Heart and Blood Vessels." With uniform standards, we were able to learn more precisely the nature and size of the problem we were dealing with.

As more knowledge became ours, two basic facts that were responsible for the association's ultimate change of course began to stand out: (a) that the heart and blood vessel diseases constituted a problem of far greater magnitude than had been supposed, and (b) that much could be done to control these diseases, that the old fatalism could well be replaced by hope and optimism.

From these two premises, it was clear that the public health responsibilities which the association had set out for itself had become even more pressing. Yet the association, a small group of physicians and scientists, was not organized to cope with the multiple problems which cardiovascular disease poses for the individual, his family, and the community, nor was it equipped to get its message of hope to the people.

Moreover, a full-fledged program of research was imperative if the war on heart disease was to move ahead. By the 1940's, research had already contributed to the feeling of optimism regarding heart diseases—cardiac surgery, penicillin and sulfa drugs for the prevention of rheumatic fever and subacute bacterial endocarditis—and it could be counted on to produce other advances.

The time had come for a broad community approach to the cardiovascular diseases. Addition of the lay public to the ranks of those already fighting heart disease was the logical first step. Citizen support was needed to finance research, for the channeling of new and existing information to the public as well as to professional groups, and the development of community services for the patient with heart



In the "pleated balloon" test, which measures vital lung capacity, patient raises top panel as high as possible. This is part of the Cleveland Area Heart Society's cardiac work classification clinic procedure to help measure the patient's work capacity.

epidemiological evidence established the relationship between streptococcal infections and rheumatic fever.

### Community Service

Although the research programs can be actively participated in by only a few hundred individuals, the AHA's community service program is entered into by thousands of men and women, physicians and laymen alike.

Because they are planned and carried out locally, heart association services vary from community to community. The American Heart Association sets general policies and gives guidance, and the State or regional affiliate gives its support and help, but the actual work is in the hands of the heart association in the community.

A local heart association does not try to solve all of the community's heart disease problems singlehandedly. "Heart disease will not be conquered by the lone wolf approach" has been echoing in heart association ears ever since it was first declared at the First National Conference on Cardiovascular Diseases, held in Washington in 1950 and sponsored jointly by the American Heart Association and the National Heart Institute, Public Health Service.

In tailoring its programs to the community, a local heart association may work at different times with parent-teacher associations, social

work and welfare agencies, labor unions, business and church groups, and other voluntary and official health agencies. It should at all times maintain a close working relationship with the local health department.

A typical community service program might include clinics for patients with cardiovascular disease, rheumatic fever prophylaxis, rehabilitation services and work evaluation units offering to cardiac patients and housewives simpler work methods, vocational counseling, nutritional guidance for patients with heart disease, and home care.

### Clinics

The clinic has long been an important concern of heart associations and frequently serves as a focal point for the entire community program. Although heart associations do not actually operate clinics, they help insure the best possible services for the patient by granting certification to local clinics that meet the standards established by a national AHA committee, as outlined in the AHA booklet, *Recommended Standards for Cardiovascular Clinics*. In addition, a heart association often buys equipment for a clinic or contributes, on a demonstration basis, toward the salary of a medical social worker, a public health nurse, or other professional worker.

### Rheumatic Fever Programs

Most heart associations are developing community programs for the prevention, control, and treatment of rheumatic fever. Rheumatic fever committees of heart associations work closely with physicians to encourage the widest use of antibiotic preventive techniques presently available. They support community diagnostic services, cooperate with school health authorities to develop screening procedures, and in some cases sponsor traveling clinics for isolated rural areas. Several such traveling clinics have been organized in cooperation with the State or local health department.

### Rehabilitation Program

The cardiac rehabilitation program helps patients with cardiovascular disease to remain independent, self-supporting members of society, thus bringing them psychological as well as eco-



## Research

Since 1948, a total of approximately \$13 million has been allocated by the American Heart Association, its affiliates, and their chapters for research support. Affiliates and chapters which make research awards in their own areas do so in addition to their contribution to the national research fund.

The association offers research support at three levels: research fellowships and established and career investigatorships.

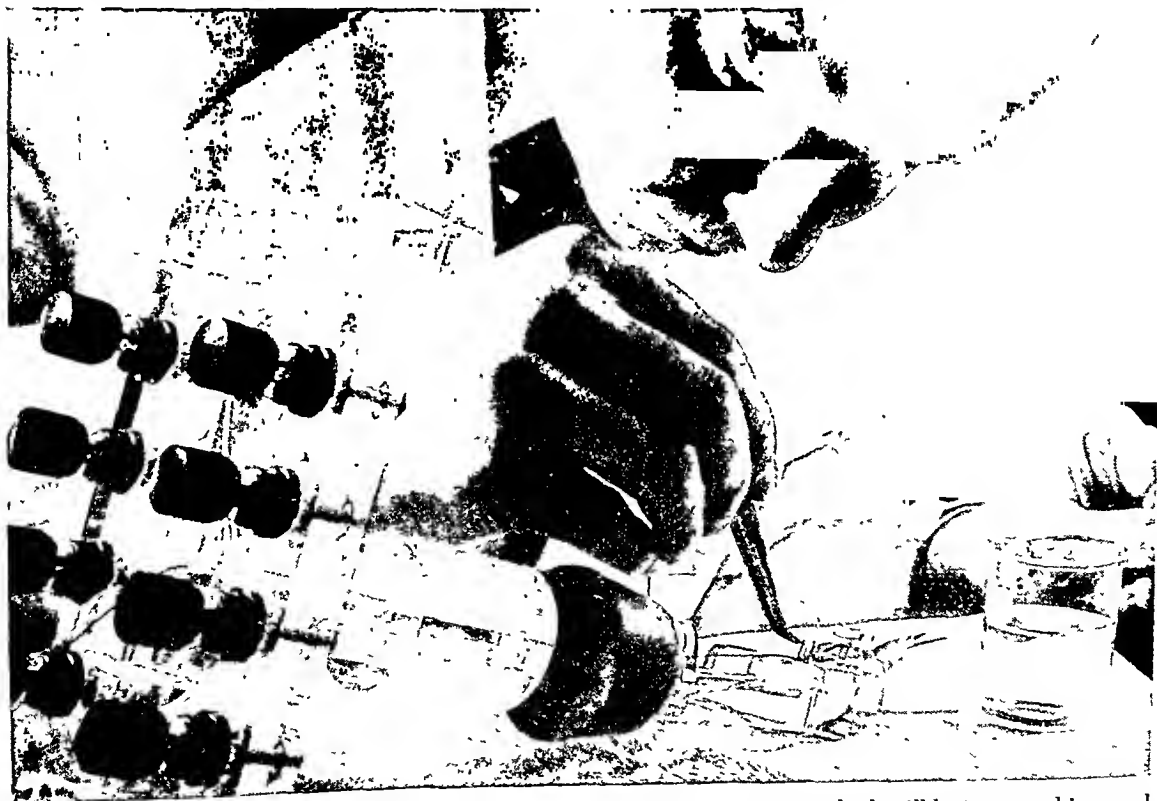
Research fellowships are granted to young men at the outset of their careers, for a 1- or 2-year term, to enable them to train as investigators under experienced supervision.

Established investigatorships provide support for a 5-year period to scientists who have demonstrated their capacity in research and have developed to the point where they are independent investigators.

Career investigatorships, now held by three men, provide an annual stipend throughout the productive lives of carefully selected scientists of proved and outstanding investigative capacity and genius.

In addition to these three forms of research support, grants-in-aid are awarded to provide the tools of research—technical aid, equipment, and supplies—to experienced investigators working on a specified program of research.

Epidemiological research—studies of diseases of the heart and blood vessels in terms of their incidence and prevalence among population groups with varying characteristics—is beginning to take its place beside basic or experimental research, for which it supplies the clues. For example, the association of overweight and mortality from heart disease was one of the leads that gave impetus to experimental studies of cholesterol and lipoproteins. Similarly,



Investigator placing heart muscle between the electrodes of a plastic holder, which will be immersed in vessel of warm salt solution (right) and then stimulated to contract rhythmically. As different drugs are added to the solution, their effect on the muscle's action can be observed in detail by instruments which record the force of its contraction and the electrical impulses generated by it . . . to gain a better understanding of how the heart muscle works and to improve methods for treating it when its pumping action is impaired.



Work conference sponsored by the Washington State Heart Association in cooperation with schools of nursing and the State health department. Special training courses, workshops, and work conferences such as this improve nursing care for cardiac patients.

justify—these are the goals of the association's program of community service and education."

### Education

The educational efforts of the American Heart Association fall into two main categories—programs directed at physicians and other professional groups (nurses, dietitians, teachers, clergymen) and programs directed at the general public and special lay groups (parents, patients, workers).

The AHA education program for physicians is designed to make available the mass of new and existing knowledge in the field of cardiovascular disease. The annual scientific sessions are probably the most comprehensive presentation of developments in cardiology. In addition, affiliated and local heart associations

schedule scientific meetings, forums, post-graduate courses, and other events for the medical profession in their areas, often in cooperation with the local health department and medical societies.

Publications for physicians include two scientific journals, *Circulation*, a monthly, and *Circulation Research*, a bimonthly. These have become outstanding media for reports on clinical and basic science subjects. In addition, the bulletin, *Modern Concepts of Cardiovascular Disease*, reviews a specific cardiovascular subject each month.

Handbooks, manuals, and other materials are also issued to help physicians. These include recommendations for blood pressure determination and for examination of the heart; the previously mentioned book on nomenclature and criteria (prepared by the New York Heart

conomic benefits. A pioneering development in this area is the work classification unit, often attached to a cardiac clinic. Each unit provides a counseling service to which physicians and industry may refer patients with employment problems stemming from cardiovascular disease. Here the patient's work capacity is assessed by a team representing several professional disciplines, as a basis for selective placement in a job where he can perform fully without overtaxing his physical reserve.



Physician watches the "master two-step exercise test" in the New York Heart Association's work classification unit. Patient climbs the steps, turns around, and goes down 20 times while "hooked up" to the electrocardiograph. Immediately after the exercise he lies down and receives an electrocardiograph examination.

Together with other services, such as the sheltered workshop and vocational guidance, the work classification unit does much to aid the physician in the practical management of the patient. At the same time it helps to break down the barriers that still keep many capable

patients with heart disease from productive employment.

In the "Heart of the Home" program, rehabilitation principles have been adapted to the needs of the housewife with cardiovascular disease. Housewives are taught how to simplify their work habits and conserve their strength. Special courses are given by heart associations for cardiac homemakers and for those who frequently come in contact with them—nurses, occupational therapists, home visitors.

### *Nutrition Program*

The problems of overweight and diet have occupied the attention of many local heart associations. A number of heart associations, working with their health departments, have organized weight-control groups, and several have given low-sodium-diet cooking classes.

On the national level, the American Heart Association, in cooperation with the Council on Foods and Nutrition of the American Medical Association and the Food and Nutrition Board of the National Research Council, developed recommendations for more precise labeling of the sodium content of special dietary food products, which were incorporated in 1954 in the official regulations by the Food and Drug Administration. Although neither the American Heart Association nor its branches approve or disapprove of specific dietary food products, local heart associations should be able to refer patients to sources of dietetic foods in the community.

### *Chronic Illness*

Another area of community service concerns chronic illness. Home care programs are being explored now as a way for heart associations to cooperate with other community groups in such projects.

In whatever ways a heart association carries out its program, the underlying philosophy is one expressed by Dr. Martin Cherkasky, chairman of the Council on Community Service and Education: "To help those who suffer from heart disease reap the benefits of ever-expanding knowledge, to help them meet the practical problems which illness creates for most individuals, to help them learn the message of hope which the achievements of recent years fully

are financed by public funds, both agencies are responsible for seeing that the funds are not wasted through overlapping or competitive programs.

"A practical arrangement is to have an officer or board member of the heart association on the health department's advisory committee and to have a member of the board or staff of the health department on the board of the heart association.

"This does not mean that every enterprise must be a joint one; each agency maintains its identity and individuality because each has something different to offer. The broad community representation in the heart association makes it possible for the association to furnish leadership, to act as a pioneer in program development, and to stimulate the official agency to make the best possible use of its resources of money and personnel. Very often the two agencies working together can accomplish more than they could achieve separately."

How does this statement work in practice?

In New York staff members of the statewide heart affiliate spend 2 or 3 days each year in meetings with representatives of the State health department, welfare department, and division of vocational rehabilitation. At these meetings, government and heart association personnel exchange ideas and information on rehabilitation, public health nursing and education, school health, chronic disease, and other areas of mutual concern.

Not only do the groups find they understand each other better, but often new programs develop as a result of these sessions. From the liaison in New York, the heart affiliate undertook a demonstration project in rehabilitation at the suggestion of the State health department. The health department will take over the project—paying the salary of a rehabilitation counselor on the health department team—at the end of the 3-year demonstration period.

Sometimes the financial responsibility for projects is reversed, as in the cardiac work classification unit of the Heart Association of Southeastern Pennsylvania. The Pennsylvania Department of Health finances the unit, which provides for service to individuals whose employment problems are caused by cardiovascular disease.

One of the reasons heart associations find it so important to work with their local health departments, medical societies, and other groups stems from the AHA policy of spending money not for individual care but for community programs in cooperation with others, for demonstration projects where needed facilities do not exist, or for salaries and equipment to supplement the services of some other agency.

Behind this policy is the belief that the association's purposes will not be best served by giving financial aid to individuals to cover the costs of medical or nursing care, hospital bills, or drugs. Tremendous sums, far greater than those available to the association, would be necessary to meet such requirements on a fair and comprehensive basis. Moreover, diverting the association's limited funds to comparatively few individual patients would undermine its ability to carry out the program it has evolved to benefit all heart patients and to reduce cardiovascular disease as a threat to the Nation's health.

### Health Department Problems

The American Heart Association recognizes the difficulties faced by health departments in meeting the problems of cardiovascular diseases. Shortage of funds, insufficient personnel, hands full just keeping up the traditional health department functions—these are familiar conditions. Yet, as the communicable diseases fade as a major health problem and the chronic illnesses take their place, changes will be appropriate and possible.

A recent study made in Buffalo, N. Y., reveals that crowding, water supply, and sewage disposal have little bearing on four of the most frequent causes of death—heart disease, cancer, stroke, and diabetes (2). Certainly this is not to say that health departments should lessen their vigilance on the old problems. They will still be with us. And, as the Buffalo study also shows, deaths from infective and parasitic diseases are related to housing, water, and sanitation. But in time, control of these will be left-hand functions of the health department. As the chronic illnesses become more pressing problems, the emphasis will shift.

Until public awareness and financial re-

Association), standards for electrocardiography, and recommendations on cardiac catheterization and angiocardiology.

Audiovisual tools for medical teaching and meetings are a recent development. They include heart models, films, slides, tape recordings of normal and abnormal heart sounds, a three-dimensional visual kit (Cardio-Views), and an audiovisual kit (Cardiac Clinic), which combines slides and a recorded medical discussion.

Most heart associations plan educational meetings, forums, and workshops for other professional groups. Frequently, as in workshops in cardiovascular nursing, these are held in cooperation with the health department and other community agencies and organizations.

Several heart associations have held pastoral counseling meetings for clergymen; and many have brought together groups of teachers, social and vocational workers, occupational and physical therapists, and dietitians and nutritionists to discuss the needs of the cardiac in relation to their particular profession. A number of heart associations conduct special industrial education programs to tell both workers and employers the "cardiac can work" story.

The public education program of the association, conducted on the national and local levels, has been a major factor in creating a climate of optimism and confidence that grows out of a rational understanding of heart disease. Booklets and pamphlets, films, exhibits, and meetings are planned to stress accurate information without exaggeration or distortion, to correct misconceptions, to substitute encouragement and realistic hope for the fear and fatalism of the past, to emphasize the scope of the cardiovascular problem and the belief that heart disease can ultimately be controlled through research, and to urge prompt and proper treatment of heart and circulatory disorders.

The national office provides the general reader with a continuing progress report on advances in the heart program through its quarterly periodical, *The American Heart*, and through its press information services.

Both the national office and its local associations maintain inquiry services to answer specific questions from individuals and professional persons in need of information and ad-

vice. In addition, most local heart associations maintain a speakers bureau to provide well-informed public speakers, usually physicians, to interested groups.

### Association-Health Department Relation

At about the same time the American Heart Association became a voluntary health agency, the National Heart Institute came into being as one of the National Institutes of Health. In 1950, lay and professional leaders of the two groups met together in Washington for the First National Conference on Cardiovascular Diseases "to determine what we know about cardiovascular disease and how we can apply this knowledge to prevent and cure it." What came out of the conference became the basis for much of the work that both groups have since done.

This past year, the National Heart Institute and the American Heart Association undertook an educational campaign against rheumatic fever, jointly preparing materials for distribution to health departments and heart associations. The basis of the campaign is a 4-page statement by the AHA Council on Rheumatic Fever and Congenital Heart Disease, entitled "Prevention of Rheumatic Fever and Bacterial Endocarditis Through Control of Streptococcal Infections." This was issued first in 1953 and revised in 1955. Other educational materials in the "Stop Rheumatic Fever" unit (1) include a black-and-white film, discussion guide, and leaflets.

The Manual on Administration and Organization for Affiliates of the American Heart Association clearly spells out the heart association-health department relationship:

"Official agencies are legally charged with the responsibility of protecting the public's health. Heart associations have voluntarily assumed a share in this responsibility and should work closely with official agencies toward their common goal.

"Any programs undertaken by a heart association should be brought to the attention of the health department. A number of health departments have developed extensive programs for the control of heart disease. Because these programs, like those of heart associations,

# The Epidemic Climate

By WINSTON H. PRICE, Ph.D.

IN THE 16th century, Fracastoro formulated the idea that communicable diseases were caused by "living agents," a thought that occurred to earlier minds but, except for the scabies mite, without supporting evidence that survived to modern times. Later investigators, such as Snow, Henle, Panum, Budd, Holmes, Semmelweis, and Hirsch, inferred the probable existence of such agents strictly by epidemiological methods. However, it was only after invention of the achromatic microscope that Pasteur, Koch, and their followers, using Henle's principles, demonstrated that microorganisms are the primary cause of certain diseases. This important work put on a firm scientific foundation man's understanding of the pathogenesis of infectious disease.

Since that time many other etiological agents (helminths, protozoans, fungi, bacteria, rickettsiae, and viruses) have been identified with diseases of both man and animals. Principal interest has focused upon the differential disease diagnosis and pathogenesis and the treatment of the patient. In comparison, relatively little attention has been paid to the biological survival mechanisms and mode of transmission of

infective agents in a community, particularly during the endemic prevalence or during the interepidemic period. There has also been relatively little investigation of the factors that determine the fluctuations in incidence and distribution of communicable diseases or of those fundamentals that are of importance in determining whether an infection regresses spontaneously or evolves into an overt disease. There is evidence that such factors as climate and season and the nutritional state and hereditary constitution of the host are factors in the natural history of microparasites, but there is little experimental data to indicate just how these determinants influence the spread and survival of the infective agents.

It was recognized early by such investigators as Koch, Pasteur, and Pettenkofer that, while specific agents caused specific illnesses, many other factors were also important in determining whether an individual harboring the infectious agent became diseased. Later workers have expressed similar views—the most recent, Burnet (1) and Dubos (2). However, although there has been much speculation, science has yet to define the circumstances which determine why in certain infections many individuals become infected but few become diseased.

The importance of the biological approach to epidemiology was fully appreciated by Frost (3). In 1934 Theobald Smith, in his Vanuxem lectures on parasitism and disease delivered at Princeton University, formulated concepts which were fundamental to the explanation of these phenomena.

Hamer (4), Soper (5), Hedrich (6), McKendrick (7), Wilson and Burke (8) and Reed of Johns Hopkins University tried to rationalize the occurrence of epidemics by the use of sta-

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sources and sufficient personnel make the shift possible, what can a health department do so far as cardiovascular diseases go?

A health department, with little or no extra expenditure of time, money, or energy, can accomplish much simply by becoming heart conscious—being aware of the entire cardiovascular problem and letting this awareness pervade thinking and planning in all service and education programs:

Films taken in mass X-ray surveys can be read for possible heart disease and suspected cases followed up for diagnosis and treatment.

In prenatal clinics, special attention can be paid to pregnant women who have congenital or acquired heart disease.

Programs to control communicable diseases can include control of streptococcal infections.

Laboratory facilities can be used for blood sedimentation rates and antistreptolysin-O titers in suspected rheumatic fever and throat cultures in suspected streptococcal infection; laboratory technicians can be trained in prothrombin-time determination.

Nursing and convalescent homes can be inspected from the point of view of nutritional requirements and physical limitations of cardiovascular patients.

In nutrition programs, emphasis can be placed on counseling as regards various nutritional needs, such as the low-sodium diet for hypertension and congestive heart failure, and on problems of overweight.

In school health surveys, children with congenital or rheumatic heart defects can be discovered. Through followup services they can obtain the care and management possible through a greatly expanded knowledge in the two fields. It is here that the Crippled Children's Program has so much to offer.

Public health nurses can be instructed in the nursing care of cardiac patients.

A clearer picture of the cardiovascular problem can be obtained through careful record-keeping.

In all health education programs, cardiovascular disease can be treated to dispel fear and replace it with a reasonable, more objective viewpoint. Teachers and parents can be informed about the relationship of streptococcal infections to rheumatic fever.

All these are things which health departments can do within their existing framework. A number of health departments, of course, are engaged in major programs related to cardiovascular disease.

The cardiovascular disease studies being conducted in Massachusetts, California, and New York State, among others, are calculated to give us the kinds of information that will more clearly define health department and heart association roles in prevention and control of cardiovascular diseases through organized community effort.

In these heart disease control programs, "prevention" is the key word. "Characteristically," writes Lester Breslow, chief of California's bureau of chronic diseases, "the public health approach to problems stresses prevention. As applied to heart disease and other chronic diseases, prevention includes measures which avert the occurrence of disease (primary prevention) and those which halt or retard the progression of disease into disability or premature death (secondary prevention)."

However much a health department is able to do now, and does do, it can be sure of having the help and support of its neighboring heart association. Heart association and health department alike are both working toward the prevention, in its broadest sense, of cardiovascular disease.

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C. for 24 hours or by a blood meal (13). The avirulent phase and its reactivation have been observed in the field, and it, therefore, may be presumed to play a role in the natural history of this agent (13).

This work shows that an infective agent may persist in the host's tissues over a long period of time in a form not detectable by laboratory techniques. In view of this possibility, the failure to detect an agent by the usual infectivity tests does not necessarily mean that the parasite is not present. Accordingly, when studying the natural history of a microparasite, it is desirable, when practical, to test for the presence of an agent not only by infectivity tests but also by challenging animals with a known virulent suspension of the organism being investigated or by interference tests (14). For example, in studying the natural history of a mosquito-borne virus, the failure of a mosquito suspension to cause disease when injected into a mouse does not necessarily mean that the agent is not present. It is conceivable that the agent is there but is in an avirulent, or masked form. This same mouse, challenged one month after the initial test inoculation with a virulent suspension of the virus, may prove to be immune because antibodies were stimulated by the avirulent phase.

Field observations and laboratory experiments with *Rickettsia prowazekii*, the etiological agent of epidemic typhus, have shown that many persons may harbor the microparasite years after infection (15-17). The microparasite may become reactivated and cause Brill's disease, or recrudescent typhus, in the hosts. These persons may then infect human body lice which feed on them (16). Man, therefore, may serve as an interepidemic reservoir for this agent, as originally proposed by Zinsser (15).

The question of latent infections and what activates them is one of the practical, fundamental problems of infectious diseases, both to host and to the scientist seeking to learn how the microparasite survives in nature. The importance of this problem was pointed out by some of the earliest investigators of infectious diseases, and more recently by Shope (18, 19).

The primary objective of this type of study, of course, is to try to determine the factors that initiate infection. Once the disease occurs, the

agent may be carried from host to host in a manner totally unrelated to the activation process. For example, in swine influenza the virus exists in the lung worm which is harbored in the lung of the swine. The virus is in a masked state. Following some provoking experience, the virus is activated; the animal then becomes sick with swine influenza and can spread the agent to other swine by contact (19). With typhus, once a louse feeds on a person who has recrudescent typhus, the louse to man to louse cycle can foment an epidemic.

It is still far from clear why specific microparasites vary in incidence and cause epidemics when they do, and why epidemics subside when they do. In our studies on RMSF, for example, seasonal tests on approximately 3,000 ticks for 4 successive years in an area in Maryland showed that the percentage of infected ticks varied only from 0.2 to 0.3 percent each year. Yet during this time there were each year many nonimmune susceptible animals and a countless number of uninfected ticks in the area. The uninfected ticks from this locality could be readily infected in the laboratory by strains isolated in the area. One possible conclusion is that one or more unknown factors in nature contribute to maintaining RMSF in this locality (20).

## Influenza

### *Profile of an Epidemic*

In our respiratory study, approximately 3,000 persons are under intensive observation; 800 of these are student nurses and medical school students in the Johns Hopkins Medical Institutions.

During the winter of 1954-55 there was an outbreak of influenza B in the 800 students. It began the middle of December, reached a peak the middle of January, and subsided about the second week of February. About 20 percent of the 800 subjects were infected with influenza B as determined serologically by the hemagglutination-inhibition test.

Some interesting data have been accumulated for the 240 student nurses in the group. These nurses are between the ages of 18 and 22. They all live in the same dormitory and eat at the same cafeteria. During the influenza B



tistical formulas. Given the number of cases of measles, the number of susceptibles, the total population, and assuming an arbitrary value for contact rates in one time period of 14 days, the number of new cases which will arise in the successive time periods of the same length can be calculated. Epidemic theory of this sort yielded some interesting concepts about the spread of contagious disease. However, for infectious diseases, the practical usefulness of this statistical theory is quite limited (9). It is impossible with these criteria to take into account and to evaluate the many factors influencing the propagation of an infectious agent in nature.

Another approach to the study of the epidemiology of communicable diseases is the mass serologic survey for which Paul has coined the term "serologic epidemiology." This method has proved of value in such diseases as poliomyelitis and yellow fever. However, in recent years it has become obvious that in certain communicable diseases, such as those caused by certain arthropod-borne viruses, the results of the mass serologic survey technique must be interpreted with the utmost caution. There is an immunological overlapping among the various members of the arthropod-borne viruses, and, too, certain of these viruses appear to require accessory labile human serum factors for the neutralization test. While this latter difficulty can be overcome by adding fresh normal human serum to all neutralization tests, there is no way to reduce the error which arises from the serologic relationships among viruses.

At the writer's laboratory in the Johns Hopkins University School of Hygiene and Public Health, we have approached the study of infectious diseases by attempting to analyze some of the ecological factors in the natural history of certain microparasites. Principally, we have been interested in the part played by the infected human or animal and in such phenomena as the origin of the first infection or case of the disease, the relation between infection and overt disease, the interepidemic reservoir, activation of latent infections, and factors in nature that determine the variation in virulence and antigenic composition of the causative agents. In all this work we have tried to use experimental conditions approximating as closely as possible

those that appear to exist in nature. We have used the original isolation of the microparasite whenever possible and infected the experimental host in as natural a way as possible.

Many of our experiments during the past 4 years have been directed at understanding the factors influencing the survival of rickettsial in nature. More recently, this work has been expanded to include human respiratory and arthropod-borne viruses.

The remaining part of this report is concerned with a general discussion of our results thus far together with the related findings of many other workers. Certainly, the point of view presented is not new, but it is one that has not received as much investigation as it deserves.

Attempts to solve these problems involve long-term studies. For this reason, particularly in our virus investigations, only preliminary data are available. The research program described in this report is a large and varied one. It was specifically organized in this manner in order to train workers in the use of a combined field-laboratory approach to disease problems. We have found that this is best done if the investigator is able to work with different diseases that have different survival mechanisms in nature.

The first experiments deal with the rickettsial diseases, Rocky Mountain spotted fever (RMSF) and epidemic typhus. Subsequent discussion deals with human respiratory diseases and certain arthropod-borne viruses.

### Rickettsial Studies

It was established by the classical work of Ricketts (10) and Wolbach (11) that *Rickettsia rickettsii*, the etiological agent of RMSF, is maintained in nature, first, by transovarial and transtadial passage in various tick vectors, and, second, by infected ticks biting susceptible animals which can then infect uninfected ticks feeding on these animals. Early work by Spencer and Parker (12) and more recent studies in our laboratory have further shown that *R. rickettsii* can exist in its arthropod vectors in a phase that is avirulent for animals (13). Virulence can be restored by passage through one egg or by keeping the tick at 37°

Table 1. The relation between blood serum hemagglutination-inhibition (HA-I) titer, October 1954, and incidence of influenza B, December 1954–February 1955

Persons tested	HA-I titer	Percent showing clinical and serologic evidence of influenza B infection
50	<32	58.0
73	32	35.6
178	64	17.4
119	128	7.6
51	256	3.9
9	512	1.1
2	1,024	0

epidemic. Epidemiological and laboratory studies indicated that in the student nurse group about 85 percent of those who developed influenza B had clinical illness, 15 percent of the cases being subclinical.

Many earlier workers have found that many persons with a high blood antibody titer seem to be more resistant to influenza than those with a low antibody titer. However, this statement is not uniformly true. In recorded instances, persons with high antibody titer have developed influenza and those with low antibody titer have escaped infection. In the student nurse group, many nurses with low blood and nasal neutralizing antibody titers escaped infection although they received as much exposure as those who developed influenza. And some of the infected nurses had much higher antibody titers, both in their serums and nasal secretions, against the epidemic strain.

It is of interest to speculate that perhaps genetic differences result in greater resistance or susceptibility, and we are examining this hypothesis.

#### *Seasonal Incidence*

Why most influenza epidemics occur in the winter bears on the whole enigma of the seasonal incidence of many infectious diseases. In the Baltimore area, for example, there is no record of an influenza epidemic between the months of May and November.

It is felt that three factors determine the response of the individual to influenza: exposure

to the agent; antibody titer; and one or more unknown resistance factors. Proposed as a working hypothesis is the theory that the unknown factor is a virus resistance mechanism that is lowered during the winter months.

Studies made in an adult group over a 2-year period, from May to October of each year, in the Maryland area have shown that the influenza virus was not spread by subclinical infections in the group during summer months. Hemagglutination-inhibition titers of paired serums collected during these two periods failed to reveal one case of influenza in a population of more than 2,000 persons. About 10 percent of this group had influenza during the winter months of 1951, and about 20 percent of the group had influenza in the winter of 1952.

If influenza is being spread in this population during the summer months, it does not result in detectable antibody formation. We checked this point since it may have been argued that there were influenza cases during the summer months but for some reason such cases did not result in clinical symptoms.

Not only was no influenza found in our study group during the summer months, as measured by at least a fourfold rise in hemagglutination-inhibition titer, but the virus could not be recovered from these individuals 2 months before the 1952 influenza A-prime outbreak. Throat washings collected from 800 persons in the group the first 2 weeks of October 1951 failed to yield an A-prime isolate as determined by three amniotic chick embryo passages. In these tests each throat washing was inoculated into the amniotic sacs of three chick embryos. After 72 hours, the amniotic fluid was collected and tested for hemagglutination in the conventional manner, using human type O red blood cells. The three negative amniotic fluids were then combined, and this material was inoculated into three more chick embryos and tested as described. The whole procedure was repeated once more. During the winter epidemic the A-prime virus was readily isolated.

In 1954, during the first 2 weeks of November, we failed to isolate one influenza B virus strain from throat washings collected from 500 nurses in the Johns Hopkins Hospital. The attempted isolations from the throat washings were made by passing each washing three times

outbreak approximately 20 percent of each of the first-, second-, and third-year classes showed serologic evidence of influenza B infection. Of primary importance, however, was the isolation in early January of three A-prime strains of influenza virus from three of the student nurses during the influenza B outbreak. The nurses from whom these viruses were isolated all showed at least a fourfold hemagglutination-antibody rise against this virus and were clinically ill with influenza.

None of the other 237 nurses showed any evidence of influenza A-prime infection in serologic tests comparing blood samples taken in October with those taken the end of February and again in April. The hemagglutination-inhibition titers of their serums against these three A-prime isolations were low, 60 percent of them showing titers of less than 1:32. Seventy percent of the nurses showed blood-neutralizing serum titers of less than 1:32 against the A-prime virus. The neutralization antibody titer of their nasal secretions was usually about tenfold lower than the serum titer. These low titers were very similar to those observed when there was an A-prime influenza outbreak in the student nurse population in January 1952. As Francis (21), who was the first worker to find influenza antibody in nasal secretions, originally pointed out, the antibody titer of such secretions is very important if the pathogenesis of influenza is considered.

Here we have a situation in which the virus was present in a group that should contain a relatively large number of nonimmune persons. And yet there was no influenza A-prime epidemic, although conditions were favorable for an influenza B epidemic. The possibility that influenza B somehow kept the A-prime epidemic from developing must be considered, but it is difficult on the basis of what is known to believe that this is fact.

We have compared the virulence of the A-prime viruses isolated from the student nurse population during the peak of the epidemic in the winter of 1952 with the virulence of the A-prime viruses isolated from the three student nurses during January 1955. Samples of nasal secretions and throat washings from the latter three nurses and from three nurses clinically ill with influenza at the height of the 1952 epi-

demic showed no statistical difference in amount of virus. All samples were collected during the first 5 days of the disease and each sample was titrated in human embryonic kidney.

Two isolations from each year were tested. Five volunteers were used for each isolation, 20 in all. The viruses were all in the O phase representing the first amniotic passage. All inoculums contained the same number of particles as determined by titration in tissue culture using human embryonic kidney. The volunteers were between the ages of 19 and 26. They all had serum neutralizing antibody titers of less than 1:32 to the A-prime viruses. Two of them had a very slight neutralizing titer of 1:2 in their nasal secretions.

Eight of the ten volunteers inoculated with the 1952 epidemic strain and 7 of the 10 inoculated with the 1955 A-prime viruses developed clinical influenza. Both of the subjects who had slight neutralizing titers in their nasal secretions developed influenza. Four of the volunteers who did not develop clinical influenza had neutralizing titers in their serums and nasal secretions as high as those who developed influenza. The fifth volunteer who did not develop influenza showed a twofold increase in the neutralizing titer of his serum, but he had no detectable titer in his nasal secretions.

Similar results were obtained when the virus inoculums were diluted thirtyfold and given to another 20 volunteers.

On the basis of these tests there was no difference in the virulence of the strains of A-prime isolated in 1952 and 1955. We, therefore, have no clues as to why the A-prime epidemic occurred in January 1952 but not in 1955 since we have no evidence that antibody levels in the host or virulence of the influenza strains were the important determining factors.

The relation between antibody titer and resistance was further investigated in the 1954-55 influenza B outbreak among the student nurses and medical school students. From table 1 it is obvious that the higher the hemagglutination-inhibition titer of the individual's serum, the less chance he had of showing clinical influenza. The hemagglutination-inhibition titers given in table 1 were observed in October 1954, 2 months before the epidemic started, as measured against the influenza B virus causing the

cated by a bacterial infection might possibly harbor the virus in their lungs. It is of interest that the individuals from whom we isolated the A-prime virus did not have any evidence of clinical infection of influenza, according to their family physicians, for at least a year before their operations. But, here again the possibility of subclinical infection cannot be ruled out.

In support of the reactivation hypothesis, we have found that latent influenza infections in laboratory animals may be activated under certain environmental conditions.

Latent influenza infections have been reactivated in a number of ferrets that had recovered from a previous infection of influenza A-prime and were subjected to cold weather. This phenomenon has been identified by specific serologic tests. The same number of previously noninfected control ferrets showed no evidence of the disease when subjected to the same environmental conditions at the same time. At least two conditions seem essential in demonstrating this reactivation. The ferrets must have recovered from a severe influenza infection, and the influenza antibody titer, as measured by neutralization tests, must be low. It is not clear at present which organ or tissue contains the virus at the time of reactivation. In the only extensive tests made so far, using carefully perfused lungs of ferrets, no active virus was revealed in the lungs. In the tests, 20-percent suspensions of the lungs were passed three times in the amniotic and allantoic sacs of 11-day-old chick embryos. Infectivity was gauged by measuring the hemagglutination titer of the amniotic and allantoic fluids, using chicken and guinea pig red blood cells.

If an activation of a latent influenza infection does occur in nature, the question arises whether the latent virus exists in a fully infective form in some organ such as the lung or whether it exists in a "lysogenic" form. This latter virus phase has been described only for certain bacterial viruses (26).

In this phase, the virus exists in a noninfective phase (prophage) which appears to be attached to the bacterial nucleus. All attempts to detect the virus in this phase by splitting open the bacteria and testing for virus infectivity or by serologic tests are completely negative. When the cell divides, each daughter cell con-

tains this incomplete virus. Under certain conditions, the prophage can be activated to form fully infective particles which are liberated from the cell and can then infect all other susceptible bacteria. This represents a model reservoir virus system, and a great deal of work is now going on in our laboratory, as well as in many other laboratories, in an attempt to see if such a situation exists for animal viruses.

It should, perhaps, be pointed out that the fairly rapid decline in antibody titer in humans and laboratory animals after influenza infection does not necessarily mean that the provirus could not be present in the host. Indeed, if a provirus of influenza did exist, it would not be expected to give rise to antibody formation since the provirus of any system that has been studied is not antigenic as tested by any known laboratory procedures.

### *Immunology and Virulence*

Still to be answered is what determines the immunological and virulent properties of influenza virus in nature.

Some epidemiologists have voiced the opinion that the rise and fall of an epidemic is governed by the virulence of the agent. During the early part of the epidemic, they have speculated, the virulence of the agent may be increased by rapid passage from human to human, but as the number of immune individuals increases there is less frequent passage and the virulence of the strain is decreased.

Webster concluded that such changes in virulence play little, if any, role in determining the rise and fall of epidemic waves (27). His experiments, however, were carried out under laboratory conditions with particular bacterial systems. In the natural state, parasites encounter ecological situations far more complex than in the laboratory, and such situations conceivably can influence virulence. For example, changes in the micro-organism may occur when such agents infect persons possessing antibody.

There is no doubt that influenza isolations do vary in virulence and antigenic composition in an epidemic. In 1952 in a hospital ward at a home for the aged in Baltimore, we made 13 virus isolations during an outbreak of influenza A-prime. Careful study showed that this out-

amniotically in chick embryo and testing for influenza virus at each egg passage by the conventional hemagglutination technique; 302 of these washings have also been passed in monkey kidney tissue culture without yielding any influenza B isolations. Thus, 6 weeks before the influenza outbreak occurred in the nursing group, no influenza B was isolated, although approximately 20 percent of the nurses contracted the virus infection from the end of December to the middle of February. Virus isolations of influenza B virus were readily made during the epidemic by the same methods that failed to yield virus isolations before the epidemic.

Although these results are admittedly based on small numbers, they do at least suggest that in these two instances neither the A-prime virus nor the influenza B virus had been widely seeded before the outbreak. These results are of interest in view of the hypothesis of Andrews (22) that the virus may be seeded in the population before erupting into an epidemic. It is, of course, always possible that the virus may be seeded in some form that cannot be detected by either the chick embryo or tissue culture techniques, or the virus may be in some tissue where it would not be collected by throat washings. Andrews presented his theory, in part, to account for the early summer "flurries" of influenza that have preceded many influenza outbreaks in late fall and winter. In all these instances, after the early summer cases of influenza there were no cases of influenza for several months preceding the epidemic. Although we have no evidence that the virus is seeded during this period, here again we have evidence that with the coming of summer months human cases of influenza stop occurring (22). However, in the late fall there is a sudden outbreak of the same influenza strain that had occurred in early summer.

### *Survival of Human Influenza in Nature*

Much has been written about the biological survival mechanism of human influenza in nature. A good summary of the many hypotheses is contained in a recent article by Andrews (22). Although it is impossible in this article to go into all of the various aspects of the epidemiology of influenza, several points

should be mentioned. First, there is no evidence that a host other than man is concerned with the survival of human influenza in nature. Second, one important survival mechanism of influenza is the spread of the virus from one country to another. But, even if one pictures a yearly swing between the Southern and Northern Hemispheres, influenza A does not break out in Europe every winter (22).

Although it is difficult to find influenza in a country between epidemics, the U. S. Army Commission on Respiratory Disease (23) reported that during World War II it was able to find influenza in the United States practically every month of the year. This being so, it would appear that influenza could be maintained sporadically throughout the year, with an epidemic when the environmental factors were right.

There are also several reasons for believing that the activation of latent influenza virus may be a factor in its survival, as first suggested by Shope (24). This is an extremely difficult problem to investigate because of the widespread nature of this disease and the difficulty of ruling out the possibility of infection from a contact. The fact that the Army commission found sporadic cases of influenza throughout the year does not rule out the possibility that some of the cases represented activation of latent influenza infections, much as Murray's (25) studies in Yugoslavia showed that some of the sporadic cases of louseborne typhus fever were really due to activation of latent typhus infections and not to louse bites.

During the summer of 1954, we isolated by tissue culture methods three influenza A-prime viruses from the lungs of patients who had undergone lung operations for various conditions. These strains were not laboratory contaminants since they did not kill mice, whereas the strains of influenza virus used in the laboratory killed mice readily. Since the last big A-prime epidemic was in the winter of 1952, it is felt that these patients had harbored the virus for at least 1½ years. Of course, this assumption would be difficult to prove because of the everpresent possibility of superinfection.

However, it seems to me that some of the persons who have an influenza infection compli-

vaccination with swine influenza, 8 of the 10 children showed neutralizing titers to swine influenza between 1:64-1:256 (mean titer 1:128). However, their titers to FM1 varied between 1:512-1:4096 (mean titer 1:2018).

Five adults, ages 40 to 45, were injected with the same amount of swine influenza vaccine. These adults had initial titers to swine influenza between 1:64-1:256. Their initial titers to FM1 varied between 1:32-1:128. Three weeks after the injection of the same amount and the same swine influenza vaccine that the children received, they showed titers to swine influenza virus varying between 1:512-1:2048. Their FM1 neutralizing titer varied from 1:512-1:2048 (mean titer 1:1024). These results appear similar to those reported for the mice, since the adults, according to the work of Francis, would have had early experience with swine influenza while the children would not.

This work, therefore, supports the hypothesis of Francis that the initial influenza virus infections orient the antibody response produced by subsequent influenza infections under the experimental conditions employed.

It would appear that this phenomenon is not only of importance in the natural history of influenza, but would also be of great importance in considering how to control this disease.

### RI-APC Viruses

Another puzzling problem in respiratory viruses is that concerned with the natural history of the new RI-APC group. Hilleman (33) found that 70 to 80 percent of the recruits entering the Army got the APC infection 9 months after they were inducted. Of those recruits inducted during the winter, 70 to 80

**Table 2. The effect on antibody response of intraperitoneal and intranasal inoculation of influenza viruses in mice previously infected with different influenza viruses**

Primary infection type	Secondary treatment, intraperitoneal or intranasal, 50 days later	Viruses tested against	Mouse neutralization titer X increase after second treatment <sup>1</sup>	
			Intraperitoneal	Intranasal
FW-1-50	Swine	Swine	16	4
		WS	4	2
		FW-1-50	64	64
	FW-1-50	Swine	0	4
		WS	0	0
		FW-1-50	128	64
	WS	Swine	0	16
		WS	4	8
		FW-1-50	128	0
	Swine	Swine	512	64
		WS	2	2
		FW-1-50	0	8
Swine	FW-1-50	Swine	64	0
		WS	0	0
		FW-1-50	4	64
	WS	Swine	128	64
		WS	4	8
		FW-1-50	0	2
	Swine	Swine	0	64
		WS	8	32
		FW-1-50	2	4
	FW-1-50	Swine	0	8
		WS	16	4
		FW-1-50	2	4
WS	WS	Swine	0	8
		WS	128	64
		FW-1-50	0	2
	FW-1-50	Swine	16	4
		WS	2	4
		FW-1-50	0	8

NOTE: The above experiment was repeated 3 times with similar results. Influenza B given as the secondary treatment did not cause any increase in antibodies to WS, FW-1-50, or swine influenza virus.

<sup>1</sup> The serums of 4 mice were pooled for each test.

break arose from the introduction of an infected person into the ward.

Using a combination of 10 A and A-prime influenza viruses and the absorption technique of Jensen and Francis (28), we demonstrated immunological differences among these 13 isolates. For example, an isolate from one patient showed major antigenic components related to the Sweden and Rome prototypes, while another isolate showed major components only to the Sweden and English prototypes. A third isolate was related only to the Rome and Malayan influenza virus prototypes. There was no apparent relation between the antigenic composition of the virus isolated and antibody levels before or after infection.

All viruses isolated were passed five times in chick embryos before being used for the absorption tests. The three differing isolates described were also "purified" by three limiting dilutions in chick embryos, the second chick embryo passage being used for the dilution "purification." This was done in order to work with clones as pure as possible. Viruses prepared in this manner still showed the same immunological differences.

The 13 virus isolates could also be broken up into three groups on the basis of their behavior in chick embryos, ferrets, mice, and by tissue culture. In these tests the isolations also were purified by the limiting dilution technique. Although compared on a quantitative basis at various dilutions, 2 of the strains could not be established in ferrets even after four blind passages; 8 of the strains gave a good reaction in ferrets, and 1 isolation resulted in a mild reaction in the animals.

Some investigators have recently proposed that the recombination phenomenon might be important in determining the virulence and immunological properties of influenza viruses in nature. In this phenomenon, reproduced under laboratory conditions, two strains of influenza virus infect a cell, and some cells yield a virus that is different from the original two infecting viruses (1, 29). However, whether such a phenomenon occurs under natural conditions is open to speculation. Taylor (30) has suggested that perhaps the passage of influenza virus through persons having antibodies to various influenza types would have some part in

determining the immunological and perhaps the virulent properties of influenza strains that appear in nature. Work by Archetti and Horsfall (31) and Gerber and co-workers (32) have shown that Taylor's hypothesis can be made to operate in the laboratory.

In further work, we have experimented on the effect of subsequent influenza infection upon the antibody response of laboratory animals previously infected with various influenza viruses. The objective was to obtain a laboratory model to test further the interesting theories of Francis and co-workers that the initial influenza virus infection is important in determining the type of antibody produced by a subsequent influenza infection. They based this idea on a survey of the influenza antibody titers of different age groups. We used 5-week-old Swiss mice and inoculated them intranasally with influenza A-prime virus (FW-1-50), an A-type virus (WS), or swine influenza. Enough virus was inoculated to kill about 15 percent of the animals in all groups. Fifty days after infection the surviving mice in each group were divided into three groups and inoculated intraperitoneally as shown in a typical experiment (table 2). Antibodies were tested by the neutralization test in mice. It is apparent in table 2 that the first infection determined the type of antibody formed when the mice were vaccinated with the different influenza strains.

It was thought of interest to challenge mice intranasally after observing the intraperitoneal effects, since an intranasal test would approximate the conditions in nature. In these tests the mice had a greater tendency to produce antibody to the second virus infection than the first (table 2). It is felt that the mice were truly infected by the intranasal inoculation, whereas they were merely vaccinated by the intraperitoneal route. This may account for the difference in antibody response.

In order to test whether the above phenomenon might occur in humans on immunization, 10 children, 6 to 10 years old, were injected with a swine influenza vaccine. These children had no neutralizing antibodies against the swine influenza virus when their serums were tested in a dilution of 1:16. Their neutralizing titers varied between 1:64-1:128 against the FM1 strain of influenza. Three weeks after

been thought (36-39). Work in this laboratory has been done on West Nile (WN), Japanese B (JB), Murray Valley (MV), and St. Louis (SL) viruses.

We have found that hamsters infected with Japanese B virus and permitted to recover are protected against a subcutaneous challenge of approximately 100 LD<sub>50</sub> of West Nile or Murray Valley virus. Previous failure to observe the cross-protection between these viruses was due to the fact that in all preceding experiments mice were challenged intracerebrally. In order to see whether this immunological relationship affected the natural history of these viruses, the following experiments were carried out.

Three-day-old chicks were infected at intervals with 100 mouse LD<sub>50</sub> of JB virus and were later mated. The nestlings of these birds were subjected to further study since work of others indicates that nestling birds have an important part in the epidemiology of these arthropod-borne viruses. The nestling progeny of the infected birds contained antibody to the JB virus which was transferred through the egg from the hen. These nestlings were then infected when 4 days old by subcutaneous inoculation with 1-10 mouse LD<sub>50</sub> of WN virus or by the bite of *Aedes aegypti* infected with WN virus. Similar results were obtained with both methods of infection. Birds of the same age, species, and not previously infected were used as controls. The control birds showed maximum viremias to WN virus of approximately 10<sup>4</sup> mouse LD<sub>50</sub>, whereas the progeny of the birds previously infected with JB virus showed a maximum viremia of approximately 10 mouse LD<sub>50</sub> per 0.03 ml. of blood. Half of the uninfected *A. aegypti* feeding on the control birds became infected with WN virus. The West Nile virus was found in only 4 of the 100 tested uninfected mosquitoes which fed on the birds previously infected with JB virus and then WN virus.

The tests for WN virus were made by incubating the mosquitoes for 14 days, making suspensions of them, and inoculating these suspensions into suckling mice, 4 mice being used for each suspension. In all experiments mosquitoes of the same age and lot were used and were fed at the same time in the same numbers 1 and 2 days before the maximum viremia

as well as on the day of the maximum viremia.

In experiments conducted to test the transmission potential of the two lots of mosquitoes in one-half-day-old chicks, 28 percent of the mosquitoes that fed on the control birds were capable of transmission, whereas only 2 of the 100 mosquitoes tested in the group which had fed on the nestlings previously infected with JB virus were capable of transmitting WN virus.

All of the mosquitoes from this latter lot were also tested for WN virus after their transmission tests. They were kept for 5 days at room temperature and ground up. The suspensions were injected into mice. Two mosquitoes showed evidence of WN infection. All mosquitoes were kept for 21 days before virus transmission to chicks was attempted. Similar results were obtained in the above test system when Murray Valley or St. Louis encephalitis viruses were substituted for Japanese B virus.

These experiments approach conditions found in nature. In certain areas where a large majority of animals and humans have been infected with one type of the viruses mentioned, the serologic overlapping may tend to limit the chances that a related arthropod-borne virus will establish a foothold in the area, the result depending upon the viruses involved. It is also apparent that previous infection with one of the viruses will be of obvious importance in determining whether an individual infected with a related arthropod-borne virus develops an overt disease. In this connection, one wonders whether all the arthropod-borne viruses should be classed as neurotropic viruses. It is perfectly true that some cases result in neurotropic symptoms. However, for every host that develops neurotropic symptoms of Japanese B, Murray Valley, or St. Louis encephalitis, there may well be a thousand infected individuals who show no clinical symptoms (1). The neurotropic virus may be a rare type in the virus population, most of the viruses that make up the various members of this group being non-neurotropic.

The isolation of these viruses by intracerebral inoculation of mice would favor the isolation of any neurotropic variants. It would be of particular interest to compare the viruses thus iso-



percent developed the respiratory infection within 2 or 3 months after joining the Army. RI-APC virus types 4 and 7 appear to be involved.

During a study of 2,015 first-year student nurses, medical school students, and college freshmen in Maryland, Pennsylvania, and New Jersey for a little over 2 years, only 4 percent of them developed APC infections. Methods described by Hilleman (34) were used to detect infection. Blood samples were taken every 4 months over a 24-month period. The APC complement fixation (CF) titers of the serums collected at the first interval were compared with the titers of the serums collected at the subsequent intervals. Since the APC antigen reacts with all types of the RI-APC viruses (35), failure to detect an increase in titer against the APC antigen would indicate that these students did not develop any type of APC infection which resulted in a titer increase. Since we have found that with an APC infection the complement fixation titer remains at an elevated level for at least 4 months, the interval between tests should have been adequate to detect any antibody rise.

In view of the large number of recruits who came down with APC infections, we feel it surprising that so few of our study group showed the same type of infections since 80 percent of them were of the same sex and age as were the recruits and were subjected to similar, but by no means identical, environment.

In the student nurse group at the Johns Hopkins Hospital, four of the students developed infection with type 3 virus of the RI-APC group. Ninety-one immediate contacts, including roommates of these four nurses, were intensively studied by serologic tests and isolation attempts for 5 weeks (34). In spite of the fact that the serums of 71 percent of these contacts showed no complement fixation titer to APC viruses at a dilution of 1:4 or no neutralization titers at a dilution of 1:2 against type 3 virus, not one of the individuals showed any signs of APC infection.

In another study of 1,051 human respiratory illnesses in adults from the outpatient departments of the Johns Hopkins Hospital, Sinai Hospital, and Baltimore City Hospital, which laboratory data showed were not influenza or

of bacterial origin, only 4 percent of the illnesses were found to be caused by RI-APC viruses.

A similar low value has so far been found in 1,115 other persons we have been following in the Maryland area. This group is made up of families, adults with chronic disease, and adults between the ages of 60 and 80 who have no chronic physical ailments. Blood samples are taken every 4 months. The RI-APC complement fixation titer of their serums is then compared to their baseline level. Only 4.3 percent have shown rises in their RI-APC CF titer during the 1-year observation period. These rises would include not only clinical infection but subclinical infection with the RI-APC agents.

All these data would seem to indicate that much more investigation is needed before we can be sure just how important the RI-APC viruses are in the civilian population. It is entirely possible that the RI-APC agents may be of clinical importance in children in the civilian population, but this still would not explain why Hilleman found a 70 to 80 percent infection rate in recruits during their first 9 months in the Army.

We have no clues as yet as to why recruits develop such a high incidence of the disease. A combination of emotional strain, physical activity, and hygienic conditions or physical activity and hygienic conditions alone may be the determining factors, since the recruits are subjected to much more strenuous exercise and poorer hygienic conditions than the student group we are observing.

The work of Huebner and co-workers (35), who observed that the RI-APC viruses can be found in the adenoids and tonsils of many normal individuals, leads me to wonder whether activation of latent infections may also enter into the survival mechanism of these viruses in nature.

#### Arthropod-Borne Viruses

##### *Serologic Relationships*

Recent work by several investigators has revealed that certain arthropod-borne viruses are more closely related immunologically than had

above circumstances to the exclusion of the predominating WN particles. This situation would lead to a new antigenic WN virus population. If some of these virus particles were to multiply in another species of mosquito vector than can support the growth and transmission of the WN particles now predominating in nature, this insect vector could act as a further selective medium and give rise to a much different virus than the existing WN virus.

In view of what we know about the biology of viruses, such a speculation must be considered in a discussion of the natural history of arthropod-borne viruses.

### *Survival Mechanism*

The big question that remains to be solved concerning the biological survival mechanisms of the arthropod-borne viruses is how they maintain themselves between epidemics. In spite of the brilliant work of the Rockefeller Foundation, we still cannot answer this question for yellow fever, nor indeed for any arthropod-borne virus. In this country, western equine encephalitis poses a similar problem. No ecological complex has as yet been described which will satisfy all the requirements for an inter-epidemic reservoir. It is possible that the western equine encephalitis virus is harbored by overwintering mosquitoes. Another possibility is that the activation of latent virus infections in the animal host may play a role in the survival mechanisms of some of the arthropod-borne viruses.

Many experiments in this laboratory carried out with various species of hard ticks as possible reservoirs for western equine encephalitis have been entirely negative. However, we have observed in this laboratory that Japanese B virus loses its infectivity for a time when grown in mosquito tissue culture. The methods used would have detected about 10 Japanese B virus infective particles. When active virus appears, the increase is much greater than could be accounted for on the basis of a few infective particles multiplying and giving rise to more infective virus. It appears that in the mosquito vector this virus goes through an eclipse phase similar to that described for many animal viruses in animal cells as well as for bacterial viruses in bacteria (1). Similar results have

been reported for Murray Valley virus in *Culex annulirostris* by McLean (40). These findings, therefore, together with the fact that the multiplication of these arthropod-borne viruses in their insect vector does not appear to damage their cells, make one consider the possibility that in a few mosquitoes the virus may exist in a provirus-like state (26). In this phase the virus would be noninfective and nonantigenic under all the usual experimental conditions, but it could be activated into infective virus under certain conditions.

### Conclusion

Although the task of curbing epidemics rarely confronts us in the United States, a major responsibility of public health today consists of anticipating and preventing epidemics. This phase of preventive medicine needs to be supported by studies of the interepidemic history of infectious organisms.

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lated with those isolated by chick embryo techniques and various tissue culture procedures.

This problem is important. If the three viruses are not truly neurotropic, the pathogenesis of these diseases would have to be viewed in a different light, and the failure of most individuals to show neurotropic symptoms would not be due primarily to the resistance mechanism of the host but to the virus which infected the host.

This immunological relationship between arthropod-borne viruses may also have practical application in working out vaccination procedure against certain of these arthropod-borne viruses. For example, the killed Japanese B vaccine now in use gives little protection against the virus as measured by its ability to elicit neutralizing antibody. However, we have observed that if the same amount of killed JB vaccine is given to persons who had no previous exposure to JB virus but who had a previous WN infection, a considerable increase in JB neutralizing antibodies is observed (table 3). Serum samples of the 14 subjects were tested before treatment. None of their serums diluted 1:2 neutralized 30 mouse LD<sub>50</sub> of JB virus. Six weeks after the subjects had been infected with West Nile virus or injected with killed Japanese B vaccine, they were given a subsequent intramuscular injection of the killed JB virus vaccine. All serum dilutions were made in fresh normal human serum. None of this latter serum neutralized 30 mouse LD<sub>50</sub> of JB virus when diluted 1:2. The values in table 3 give the maximum neutralization titer after the initial treatment and 6 weeks after the subsequent killed JB vaccine injection. Weekly blood samples were taken.

We do not know as yet how long these antibodies will last in such individuals. However, it seems to me that it may be possible by using an attenuated strain of one of the arthropod-borne viruses such as WN, which shows serologic overlapping with many of the other viruses, to immunize the individual in such a manner that he can then be vaccinated much more efficiently with killed vaccines of the more virulent related viruses. It is also possible that if a person had a WN infection and was then vaccinated with JB killed vaccine, he would not only get better

**Table 3.** The effect of previous infection with West Nile virus on a subsequent injection with killed Japanese B virus<sup>1</sup>

Initial treatment	Neutralization titer to Japanese B virus after initial treatment	Neutralization titer after subsequent injection of Japanese B killed vaccine
West Nile infection-----	1:10	1:100
	1:5	1:80
	0	1:40
	0	1:60
	0	1:100
	0	0
Killed Japanese B vaccine.	0	0
	0	0
	0	1:4
	0	0
	0	0
	0	0

<sup>1</sup> All titers refer to dilutions of serum which will protect 4 of 8 mice against approximately 30 LD<sub>50</sub> of Japanese B virus.

protection against JB virus but would have some protection against other related viruses. In other words, WN infection or JB killed virus vaccine by itself would give little if any protection against Russian spring-summer (RSS) virus. But the combination of living WN infection plus killed JB vaccine may result in protection against RSS virus because of the immunological overlapping between WN, JB, and RSS viruses.

Our preliminary data support this hypothesis, and we are now in the process of determining which two viruses will give the best protection against a whole group of serologically related arthropod-borne viruses.

Immunological overlapping may also play a role in the evolution of some of these arthropod-borne viruses. For example, we have shown that if a host has antibodies to Japanese B virus and is infected with West Nile virus the multiplication of West Nile virus may be greatly inhibited.

However, if one infectious dose of WN virus were to contain a few particles that differ in their antigenic composition from the majority of WN particles, that is, if they were less closely related immunologically to Japanese B virus, these particles might multiply in the

# Unfinished Business in Maternal and Child Nutrition

By MARJORIE M. HESELTINE, M.A.

PROGRESS in recent years makes it possible to talk now about unfinished business in maternal and child nutrition. Even though we lack precise measures of nutritional status, few people doubt that mothers and children, on the average, are in better nutritional condition today than they were 20 years ago. But the very size of our accomplishments makes it necessary to emphasize that there is unfinished business. Some people seem to think we can afford to forget about nutrition programs for mothers and children and turn our attention entirely to overfed adults and the chronically ill of all ages. I dissent. Let me tell you why.

First, there is the magnitude of the problem. As Dr. Martha Eliot, chief of the Children's Bureau, pointed out to the Association of State and Territorial Health Officers in 1952, this Nation is growing younger faster than it is growing older (1). Realizing that this statement was contrary to the prevailing impression, she went on to say that during the preceding decade, the population over 65 years of age had increased 37 percent but the population under 5 had grown by 55 percent.

Because of improved maternal care, the 4 million babies that are born annually may be spared many of the hazards of delivery and early infancy. But their birth certificates carry no guarantee that they will receive the daily dietary allowances recommended by the National Research Council. If an infant is to get the food he needs for optimal growth (please note that I do not say maximal growth, a point I shall discuss later) under conditions that make for good physical and emotional development, parent education in nutrition must go on and on as long as women have babies. Then, too, there is sufficient indication that what happens during childhood has a bearing on health during adult life to warrant continuing attention to maternal and child nutrition if only for its long-range influence on health problems of later maturity, which are now so much in the limelight. Public health nutrition services should be directed toward the older age groups, but programs should continue to serve maternal and child health as well.

My colleagues in State child health and crippled children's programs offer another reason for urging no diminution in maternal and child nutrition work: Generalized undernutrition, they say, can still be found among children in the United States, and even cases of dietary deficiency disease are seen occasionally from cultural groups that have not shared in the widespread economic prosperity. It is true that we have to look much more sharply for instances of malnutrition than we once did, but those we see are all the more dis-

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*Miss Heseltine is chief of the Nutrition Section, Division of Health Services, Children's Bureau, Social Security Administration. Since this paper is based on her address at the 1955 meeting of the Western Branch of the American Public Health Association, the illustrations are drawn largely from the western part of the country.*

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trend to earlier feeding of solid foods are more probably social than they are nutritional or medical." And in case anyone thinks that parents take their pediatrician's recommendations without demurring, you should know that 59 percent of the pediatricians reported that they "experienced considerable pressure on the part of the mothers for the early introduction of solid foods." The consensus was that there is no physiological basis for introducing solid foods before the age of 3 months.

### For Healthy Teeth

Still another aspect of maternal and child nutrition about which we need to know much more is the relation of nutrition to healthy teeth and to their resistance to caries. It seems to be well established that the development of structurally sound teeth is dependent on a supply of nutrients that have their source in the ingested food. The argument begins on the question of the effect of diet on the susceptibility to caries of the fully formed tooth. Many discussions have been devoted to that topic, but the net result, it seems to me, is that the proponents of the various schools of thought have become more convinced than ever of the validity of their evidence whereas neutrals have become only more confused.

Fortunately, research on this question continues, and the prospects of an answer become brighter through the use of such new tools as electron microscopy and radioactive tracer techniques. There is certainly some indication from recent studies that enamel is permeable both from the oral cavity and the bloodstream.

### Diet and Pregnancy

We need to know more about the relationship of diet preceding and during pregnancy to the well-being of the mother and infant. Teams of research workers in various medical centers have approached the study of nutrition during pregnancy quite differently and, as might be expected, have often failed to confirm each other's findings. Does that mean that we should no longer claim that what a woman eats during the maternity cycle is important? A question as direct as that was put by a nutri-

tion workshop participant last summer to a young obstetrician who had just reported that a large-scale study had failed to reveal major differences between the nutritional condition of women who had had good diets and those who had had poor diets during pregnancy. As this physician was known to be an expectant father, he was asked: "What are you advising your wife to eat?" Thereupon, the nutritionists listened to the kind of dietary recommendations that they wish every pregnant woman might receive from her physician. His study may not have shown that diets somewhat below prevailing standards of adequacy had had a deleterious effect; but he was well aware of other studies that had shown diet to be important, and he wanted his wife to have the benefit of the doubt.

There would seem to be some rather impressive evidence in regard to the consequences of drastic limitation of calorie intake during pregnancy. Studies in Chicago have shown that when the energy requirements of the pregnant woman are not met, storage of nitrogen in the form of protein does not proceed at a satisfactory rate (8). Other studies indicate that women who are underweight at the beginning of pregnancy and who fail to come within a normal range during the first two trimesters have a higher than average proportion of premature infants (9). Nevertheless, I have been told of a teaching hospital that has only recently abandoned the routine prescription of a 1,000-calorie diet for prenatal clinic patients. The woman who is given such slim rations is sometimes told that it is important to control the size of the fetus. Yet there is impressive evidence that a diet so restricted as to affect the weight of the infant is pretty sure to take its toll on the mother. Periods of famine do result in lower birth weights. They also are likely to impair the health of childbearing women.

### Nutrition Education

Thus far, I have dealt only with the need for extending our knowledge of nutritional requirements and with the importance of putting into practice the concepts that have been evolved by our most authoritative leaders. But in order to put into effect what we know about nutrition, we need to know more—much more—about the

trekking in these prosperous times. The comments of a young nutrition trainee from a so-called underdeveloped country after she had taken part in a dietary survey among low-income rural families in the United States are pertinent here. In a personal letter to an understanding American friend, she wrote: "Speaking of diet, I believe that the poor people of these countries . . . have a diet more deficient than the poor of my country. In a large family of 8 members, one housewife here reported that they spent only \$5 a week for food. This whole family is ill, and no wonder. And like this family, there are others and others. I also have the impression that these people show a greater sadness because they see from so close the comforts that they would like to attain."

The task ahead in maternal and child nutrition falls into two main categories, as I see it. We need to know more, much more. We need to do more with what we already know, and even with hypotheses that we think may be confirmed by research.

### Requirements for Optimal Health

Of the many aspects of maternal and child nutrition that we need to know more about and to do more about, one is the matter of nutritional requirements for optimal health at all stages of development. In 1953 the Food and Nutrition Board of the National Research Council issued the third revision since 1943 of its Recommended Dietary Allowances (2). The ink was hardly dry on this revision before the recommendations for protein allowances during the first year of life were challenged as being unnecessarily liberal. A committee of the board is now reconsidering these recommendations, and the Academy of Pediatrics has appointed a committee on nutrition which will direct attention to the matter. These recommendations, which represent "nutrient levels selected to cover individual variations in a substantial majority of the population" and which must never be confused with minimal requirements for an individual, are sure to be revised again and again as research throws more light on nutritional needs.

We need to know much more about satisfac-

tory rates of growth in children. As two research workers said, we need to find the "answer to the important medical-nutritional question regarding the degree of conformity to a norm to be expected on the part of an otherwise healthy child" (3). Longitudinal studies, such as those now under way at the Colorado Child Research Council, have already given us a respect for individual differences (4).

Although it is not easy for Americans to give up our "bigger and better" concept, there are those who are impressed by the questions raised by Prof. R. A. McCance of London. He asks whether the attainment of large size through very rapid rates of growth is in the interests of optimal health either during childhood or in later life. The following statements from one of his lectures may whet your appetite to seek out his provocative papers on overnutrition and undernutrition (5): "Animal husbandmen have bred and fed their animals for rapid maturity and marketable qualities and political husbandmen have come near to doing the same for children. Curiously little work or thought has been devoted to a study of the desirable plane of nutrition for the different years of human endeavor."

### Introduction of Solid Foods

If infants are not expected to grow at ever more rapid rates, there may be some revision in our ideas about the time for introduction of solid foods into the diet. The Child Health Center at the University of Washington has pioneered in trying to discover whether there is any difference in the progress of babies given solids by the end of the fourth week and those not given solid foods until the age of 9 to 12 weeks. Two researchers at the center could not detect any significant difference in the development of the two groups of infants in their response to solid foods (6).

Another approach to this question was taken by a group of pediatricians. By means of questionnaires, they obtained information from more than 2,000 of their colleagues in all parts of the country (7). There was general recognition of the trend toward early introduction of solid foods, but as one pediatrician put it: "The major factors underlying the current

cooperate with other agencies in mutually beneficial programs and that they can undertake modest factfinding activities on their own.

As an example of the former, I am thinking of a statewide study of food habits of families with children that was conducted by the New Mexico Department of Public Health and nutritionists in the New Mexico Agricultural Experiment Station (12). As a result of this study, the health department has a much sounder basis for its nutrition programs in behalf of children.

I could cite many examples of the latter, but I will mention only two. A district nutritionist in Florida, with help from the State health department, worked out a device for learning what some of the words that come trippingly on the tongues of prenatal clinic staff mean to the patients. She learned, among other things (13), that to some of the patients "nutrition" is "the man who lays out dead folks." We can well believe that clinicians and nurses in that part of Florida will no longer tell a prenatal patient to "talk to Miss C . . . about your nutrition." In a county health department in California, a Spanish-speaking nurse, with the encouragement of her supervisor and help from a State nutrition consultant, undertook to find out what the Mexican-American families in her district were eating. The data she obtained would not permit an easy generalization. There was as much disparity between low-income and prosperous families as would be found in an Anglo-American group.

In conclusion, let me emphasize that the unfinished business in maternal and child nutrition is to a large extent the business of all public health workers. Seek help from the nutritionists and complain long and loud when you can't

get it. But don't expect the nutritionist to do the job alone.

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people to whom nutritional programs are directed.

Nutrition education has come a long way since the days when the nutritionist was a feminine lone ranger, who prepared her own educational material (usually mimeographed, single spaced), jumped into her car, traveled across the State to a county where there might or might not be a public health nurse, rounded up a group to listen to her talk or watch a demonstration, got back into her car, and returned to the State office. In those days, the public health nurse was not expected to know anything about nutrition. If she strayed beyond underlining the appropriate paragraphs about diet in the pamphlet she handed to a parent, she did so at her own risk. Community organization, group dynamics, the consultant-consultee relationship—all these were concepts that she had never heard of. There was no thought given to modifying teaching about foods to fit cultural patterns, for the emphasis was on Americanization. If cream soups were accepted by middle income Anglo-Americans, it was assumed the sooner recently immigrated Mexican mothers learned to make cream soup the sooner they would evolve into 100-percent Americans.

Currently, nutrition enters into the daily activities of many kinds of public health workers. A large proportion of them are equipped by training and experience to deal effectively with the run-of-the-mill nutrition problems, although, of course, they recognize the need for technical assistance from a nutritionist—hopefully one who is accessible enough to give help when it is most desired. Increasingly, nutrition consultation is focused not on what is new in nutrition but on how to make what is old (and as far as we know still true) function in the lives of people. Maternal and child nutrition teaching has been profoundly influenced by the writings of such men as Aldrich, Senn, Richmond, and Spock. Good nutrition is viewed not as an end in itself but as one factor in the development of a sound body and a healthy personality.

Knowing what is considered an appropriate diet for a parturient woman and her infant and why certain values are attributed to certain foods is only the starting point for soundly

motivated education in maternal nutrition. Beyond this, we must understand the ways of life of the people whom we are trying to teach. In work with cultural groups that have different value systems from their own, public health workers have found a new ally in the anthropologist. A paper on midwife training by Dr. Isabel Kelly (10), an anthropologist with the United States Operations Mission to Mexico, provides the following illustration of how a health worker and a social scientist may cooperate in solving a problem:

In certain Mexican villages, the women were unwilling to drink water during the later months of pregnancy or to give either water or fruit juice to their babies. As a result, both mother and child were deprived of essential fluids, and the child did not get the necessary amounts of vitamin C. Dr. Kelly and a nurse midwife worked out this solution: an increase in consumption of the herb teas that are an accepted part of the diet of these people and addition of an ascorbic acid tablet to the tea before it is given to the babies. The women were quite willing to make these modifications in their habits.

Dr. Kelly does not suggest that the practices found in these villages will persist indefinitely; she merely points out how a practice may serve effectively for the present. As Dr. Cicely Williams, who has done maternal and child health work in many parts of the British Commonwealth, states in an article on nutrition (11). "Many of the customs recorded by social anthropologists are not (as commonly supposed) unalterable but can be replaced by more rational and advantageous behavior once the position has been explained and understood. Often one sees the term 'social and cultural customs' used to dignify habits which are merely the result of ignorance and carelessness."

### Health Agencies and Research

Not only can health departments do more about applying what is known in nutrition, they can also contribute to the knowledge that is to be translated into programs. I am not suggesting that health departments should embark singlehandedly on ambitious nutrition research projects; but I am suggesting that they can

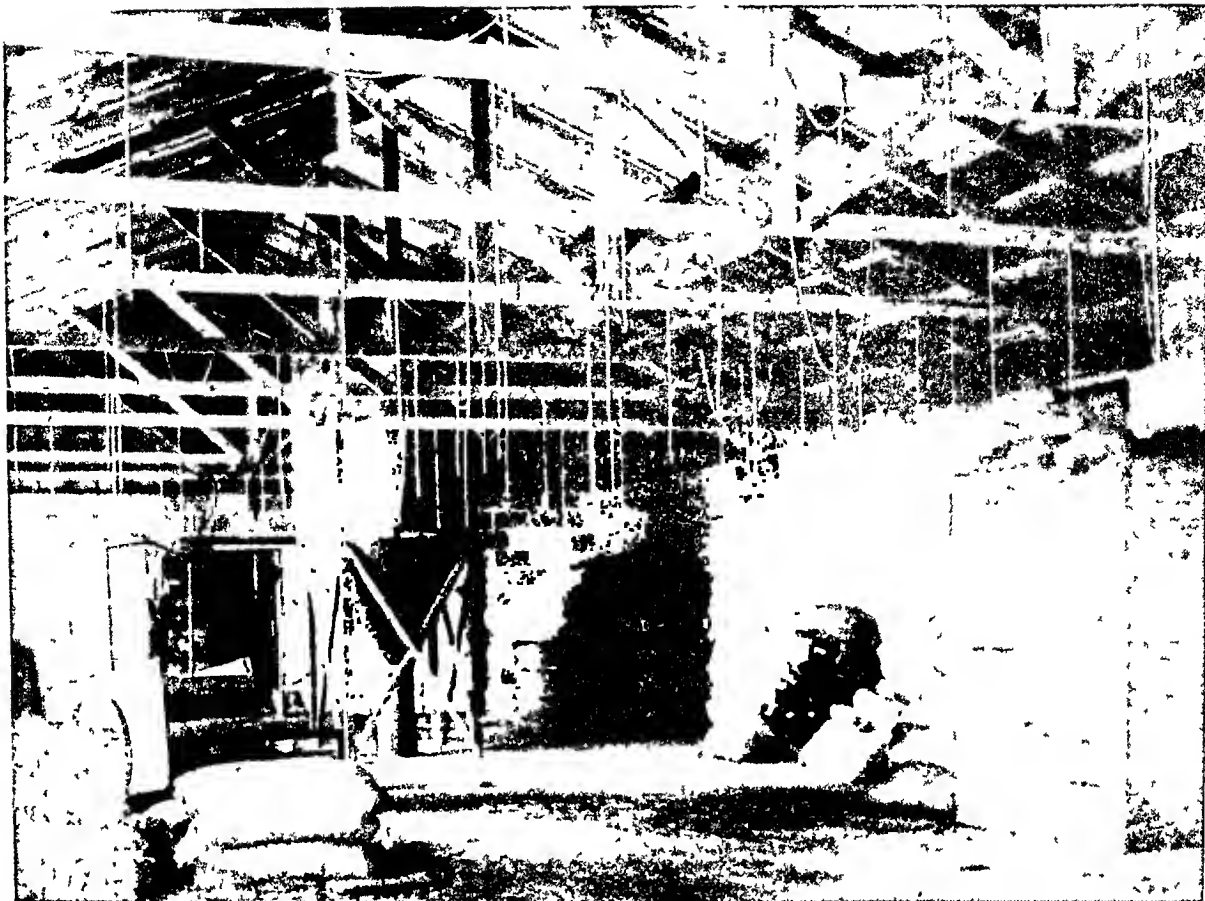


Figure 1. Insecticide-impregnated cords installed in a feedroom of a dairy.

were suspended vertically either from the ceiling or from horizontal cords extending from wall to wall (fig. 1).

In dairies and rural areas, the cords were installed at all protected potential fly-resting sites, particularly those within barns, pigpens, calf pens, and chickenhouses. In the rural area tests, treated cords also were suspended in the kitchens and on porches of unscreened houses. Treatments in military food establishments included complete installation of cords in the dining halls and partial treatment of the kitchens. In the kitchens, cords were placed so that the affected flies would have little chance of falling into food-preparation sites. Cords also were installed beneath the overhang of the entranceways.

Appraisal of the housefly populations in dairies was accomplished by selecting the highest grill count (5 counts per station) from each

of 4 stations. These stations were not fixed sites but general areas, such as stanchions, entranceways, and feedrooms. The average of the four highest counts constituted the weekly fly index. In the rural areas, 5 grill counts were made on each of 10 premises every week. The highest count at each of the premises was recorded, and the average of these counts was employed as a weekly index. In the unscreened kitchens, total fly counts were recorded. In military dining halls, the weekly fly index was made by obtaining a total count of houseflies found in the kitchen and dining hall. The fly densities were evaluated during the same time interval each week to avoid, as much as possible, variations in fly behavior.

All dairies used in the study maintained herds of 100 to 400 cows. One dairy (C, fig. 2) received installations of freshly treated cords impregnated in a 7.5-percent parathion

# The Use of Insecticide Treated Cords for Housefly Control

By JOHN W. KILPATRICK, M.S., and H. F. SCHOOF, Ph.D.

IN RECENT years, the resistance of houseflies to residual treatments of DDT and other chlorinated hydrocarbon insecticides has stimulated intensive search for new insecticide materials and control techniques. Numerous synergistic compounds have been screened in an effort to develop a chemical formulation effective against insecticide-resistant houseflies (1-3). Other fly control methods include larviciding (4), space spraying (5), and poison baits (6-8).

Baker and co-workers (9) evaluated the effectiveness of DDT-treated cords for housefly control in food establishments, while Pimentel and associates (10) used screen strips treated with high concentrations of dieldrin and festooned from barn ceilings as a means of controlling houseflies in dairies. Variations in these techniques have included the use of cords impregnated with other insecticides, including organophosphorus compounds. Laboratory studies of Fay and Lindquist (11) indicated the type, size, and color of cords most suitable for treatment and the effective concentrations of the dipping solution. Maier and Mathis (12) in 1952 demonstrated that cotton cords  $\frac{3}{16}$  inch in diameter treated with parathion gave consider-

able promise as a method of fly control in dairy barns near Savannah, Ga. Further field tests in 1953 in rural areas (13) and in dairy barns substantiated these earlier results. These tests indicated that cotton cords  $\frac{3}{16}$  inch and  $\frac{3}{32}$  inch in diameter impregnated with parathion produced satisfactory control of flies in dairies and rural areas when the cords were installed at the rate of 8-15 linear feet of cord per 100 square feet of floor area.

In 1954, field studies with cotton cords  $\frac{3}{32}$  inch in diameter were designed to evaluate different installation techniques, cord dosages, and chemicals (parathion and Diazinon). Cord installations were tested in dairy barns, rural areas, and military dining halls.

## Methods

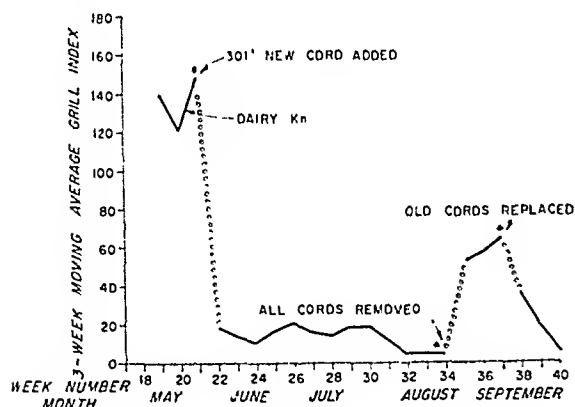
Cotton cords were treated by immersion in either a 7.5-percent or a 10-percent parathion-xylene solution which, by chemical analysis, showed a dosage of 75-100 mg. of parathion per linear foot of cord. For uniform impregnation, the cords remained in the insecticide solution for approximately 2 minutes. The Diazinon-treated cords were impregnated by dipping them in either a 10-percent or a 25-percent (an estimated 200-250 mg. per linear foot) Diazinon-xylene solution. All cords were installed at the rate of 30 linear feet of cord per 100 square feet of floor area, with the exception of one test with Diazinon-impregnated cords in which the dosage was reduced to 25 linear feet of cord to 100 feet of floor space. The cords

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**Figure 3. Control of houseflies in dairies with 12-month-old parathion-treated cords (1953).**



and fly densities remained at very low levels throughout the entire season. The second dairy (T), treated with cord freshly dipped in a 7.5-percent parathion solution, showed an immediate reduction in the fly population, but control levels were not reached until several weeks after treatment. However, once control levels were obtained, low fly populations prevailed the remainder of the season. The third dairy (Ra), treated with cords freshly dipped in a 10-percent parathion solution, showed a gradual decline in fly densities which did not reach control levels until 7 weeks after treatment. This unsatisfactory slow drop in fly densities was due in part to a disruption of normal sanitation practices coincident with the treatment of the dairy. As a result, the pressure of fly production was abnormally high. After the usual practices of manure handling were reestablished, control levels were maintained.

The effect of parathion-impregnated cords on fly populations is depicted most graphically in figure 3. In this dairy (Kn), parathion-treated cords  $\frac{3}{16}$  inch in diameter installed the previous year were allowed to remain in the dairy establishment throughout the winter months. In addition, 300 feet of newly treated cord ( $\frac{3}{16}$  inch in diameter) was installed in a recently built calf shed. Satisfactory control of flies ensued throughout the following summer. In August, all cords were removed from the barns and immediate increases in fly population levels were noted. In early September,

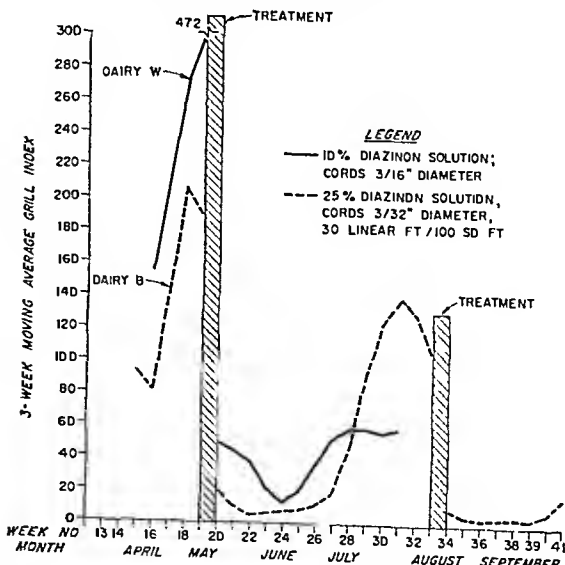
the same cords were reinstalled and an immediate reduction of fly indexes to control levels was achieved.

The results with Diazinon-treated cords are shown in figure 4. In 1953, the dairy (B) treated with cords ( $\frac{3}{16}$  inch in diameter) impregnated in a 10-percent Diazinon solution displayed substantial reductions of the housefly populations, with reduced indexes persisting for 3 to 4 weeks. In 1954, the same dairy treated with cord ( $\frac{3}{32}$  inch in diameter) impregnated with a 25-percent Diazinon solution showed immediate reduction of housefly densities to control levels, and these low levels were sustained for 7 weeks. After this period a sharp increase in fly indexes occurred. In mid-August, re-treatment with freshly impregnated cord again resulted in excellent housefly control for a period of 7 weeks.

In figure 5 are shown the comparative housefly population trends in treated and untreated rural areas. After installation of the parathion-treated cords, excellent fly control was obtained for the remainder of the season. In the untreated area, the reduced fly levels were caused by the use of poison baits by individual residents. However, fly population indexes were not lowered to the levels obtained in the zone treated with parathion-impregnated cords.

The results of installation of parathion-

**Figure 4. Control of houseflies in dairies with Diazinon-impregnated cords.**



solution and air dried for 3 weeks before installation. The second and third dairies (T and Ra, fig. 2) received installations of freshly treated cords impregnated in a 7.5-percent and a 10-percent parathion solution, respectively. The 3-week-old cord installed in dairy C was used as a means of overcoming the 3-week period usually required to bring fly populations to control levels, a lag possibly caused by the repellency to flies of freshly treated cords.

Two areas (2 x 3 miles each) containing approximately 25 houses each were selected for the rural study. In one area, the individual premises were treated with cord impregnated in 7.5-percent parathion solution; the second area served as an untreated check. The 15

premises of highest fly potential in each area were selected for grill index determinations.

Two military dining halls of similar construction and area were selected for study. One dining hall received treatment with cord impregnated in a 7.5-percent parathion solution; the other was used as an untreated check.

## Results

The results of the parathion cord treatment in dairies are shown in figure 2. Housefly populations at dairy C, which received a treatment with 7.5-percent parathion-impregnated cord air dried for 3 weeks, were sharply reduced to control levels the first week after treatment,

Figure 2. Control of houseflies in dairies with parathion-treated cords.

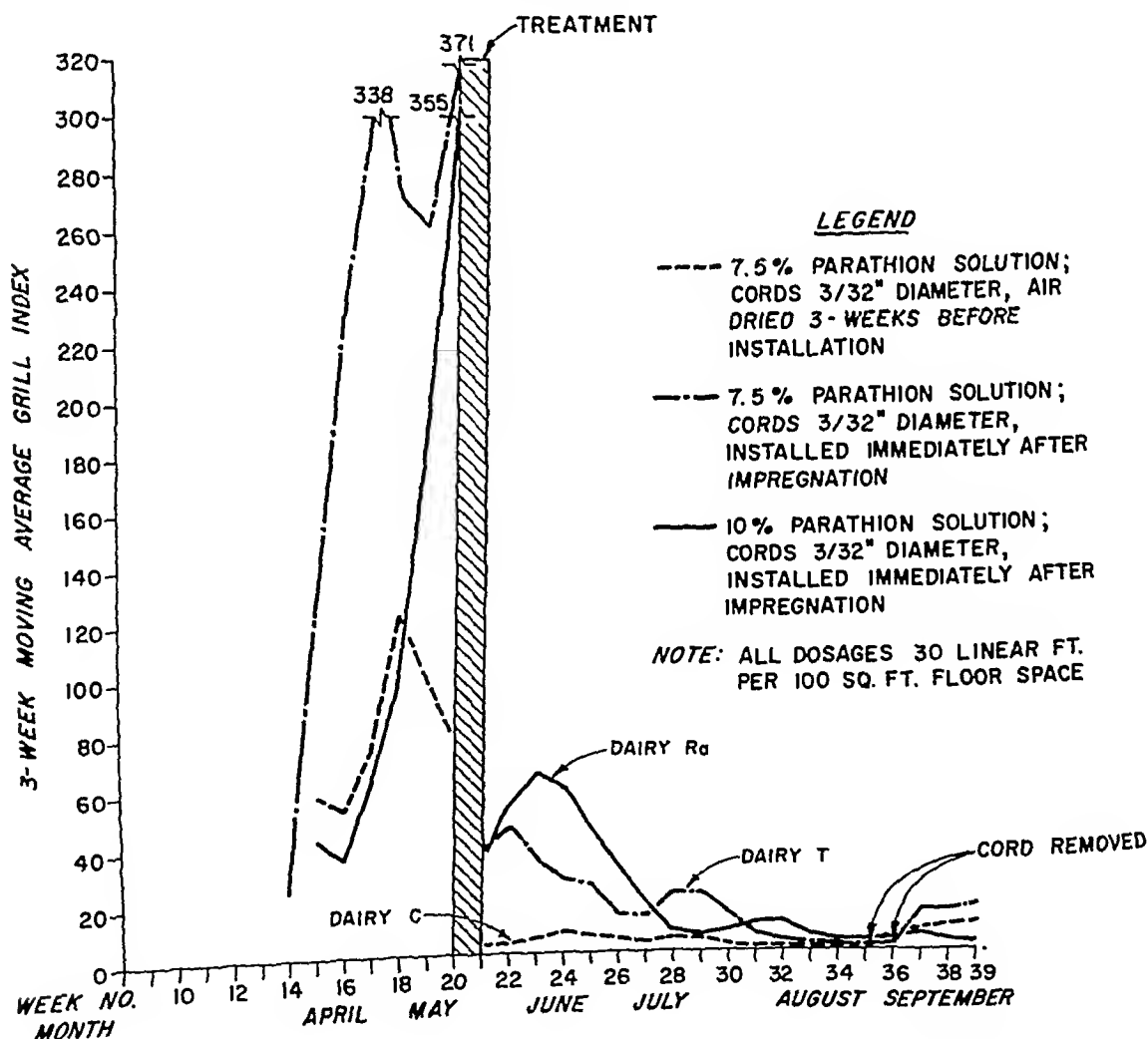
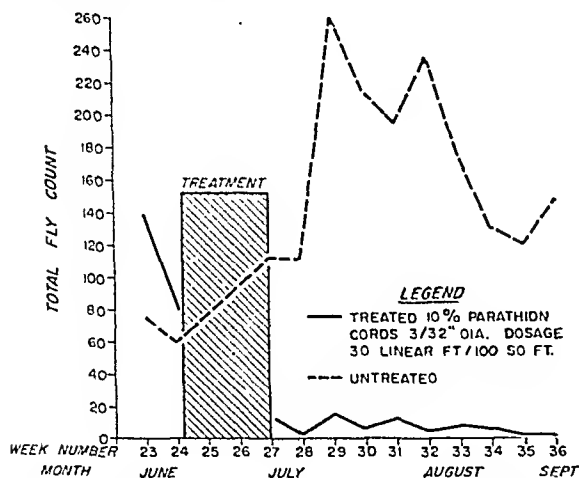


Figure 6. Control of houseflies in a military dining hall and kitchen with parathion-impregnated cords.



of the cords for a period of 3 weeks before installation tends to improve their initial efficiency. Assumptions are that during the 3-week air-drying process various fractional impurities of parathion dissipate, leaving a treated cord which apparently is less repellent to the flies. Although the dairy treated with parathion-treated cord, air dried for 3 weeks, gave the highest level of control, it should be noted that the pretreatment indexes at this dairy were much lower than at the other two dairies.

Diazinon-treated cords when impregnated by dipping in a 25-percent solution were extremely effective for periods of 7 weeks. The shorter residual activity of these cords as compared to parathion-treated cords may be compensated for under certain conditions by the lower toxic hazard to mammals.

Chemical evaluation of the parathion concentration in the air of several dairies and kitchens has indicated a level of only 0.02 microgram of parathion per liter of air. Routine checks on the cholinesterase levels of individuals preparing and handling treated cords have shown no significant change in these indexes nor have there been any reports of any toxic effects of the treatment upon the exposed human populations in the dining halls, kitchens, or dairies employed in the studies.

The commercial development of parathion-impregnated gauze in Denmark as reported by Wichmand (14) and its widespread use on

farms in that country have demonstrated that parathion-treated gauze can be used safely and efficiently by the public in fly control. Under similar conditions of commercial preparation, parathion- and Diazinon-impregnated cords offer definite promise as a general fly control measure in the United States. Such cords should be properly identified by poison labels affixed at intervals of 5 feet. In view of the toxic hazards involved in impregnating the treated cord, it is not recommended that such cords be prepared by anyone other than commercial formulators.

## Summary

Cotton cords  $\frac{3}{32}$  inch in diameter, impregnated in 10-percent and in 7.5-percent parathion-xylene solution, have given seasonal control of insecticide-resistant housefly populations in dairy barns. Cords impregnated by immersion in a 25-percent Diazinon solution yielded 7 weeks' effective control. Cords treated with 7.5-percent parathion solutions provided excellent control of houseflies for more than 10 weeks in rural areas and for 10 weeks in a military dining hall and kitchen. Air samples in dairy barns and in kitchens of rural homes revealed only 0.02 microgram of parathion per liter of air. No significant changes in cholinesterase levels were noted in individuals processing or installing parathion- and Diazinon-treated cords.

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treated cord in a military dining hall and kitchen (fig. 6) indicate excellent control of houseflies during the 10-week observation period. Total fly counts in the treated dining hall and kitchen ranged between 1 and 16 flies per inspection, whereas total counts in the untreated dining hall and kitchen ranged between 110 and 260 flies per inspection.

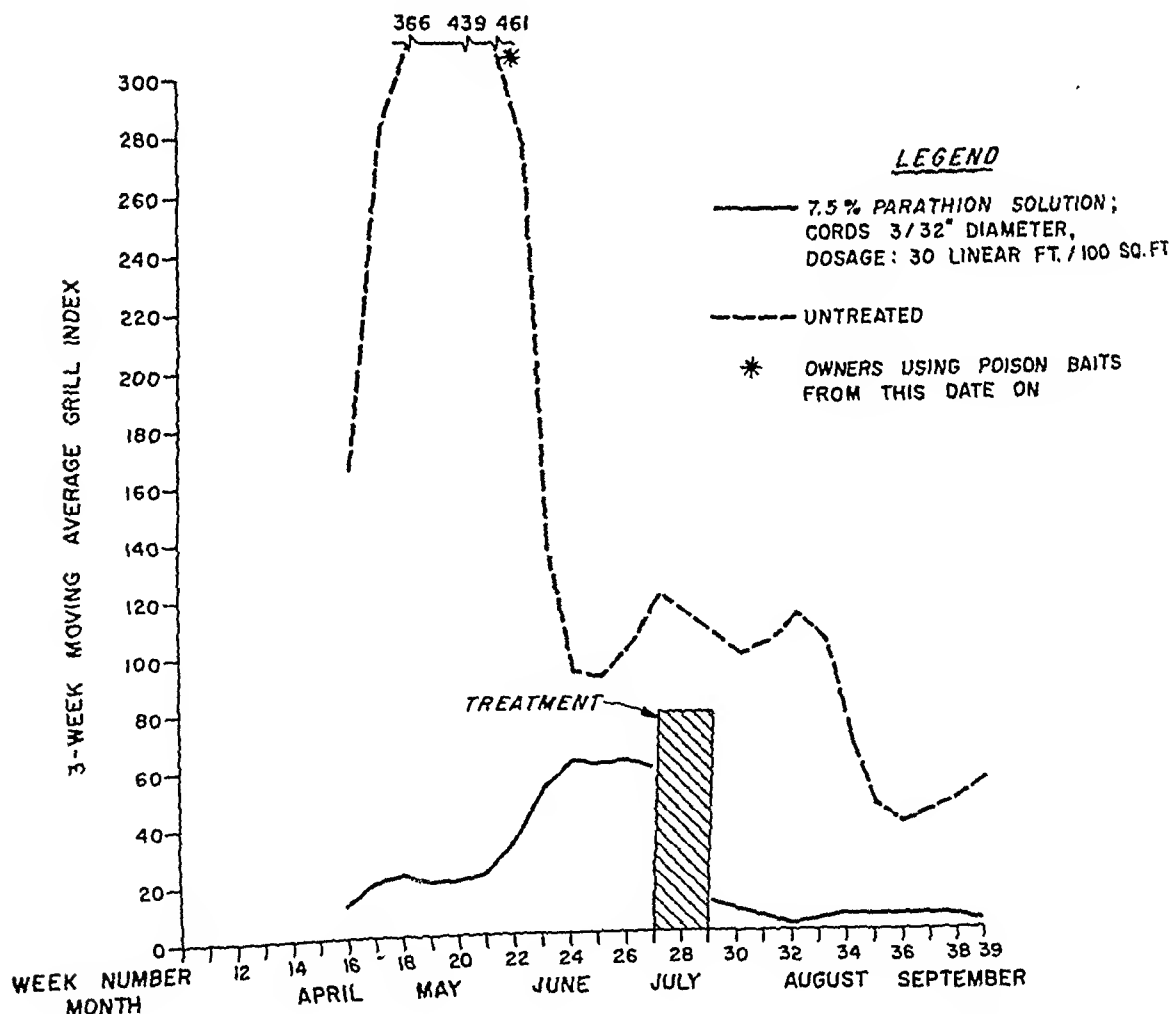
## Discussion

The use of smaller cords ( $\frac{3}{32}$  inch in diameter rather than  $\frac{3}{16}$  inch in diameter) in 1954 was based on the similarity in the control performance of cords of both sizes in previous studies. In addition, the  $\frac{3}{32}$  inch in diameter

cord is cheaper and reduces the potential hazard to humans because of the lesser amount of parathion per unit length of cord (75-100 mg. vs. 150-250 mg.). It also permitted an increase in cord dosage per 100 square feet, thereby augmenting the toxic area available for fly contact without increasing the overall amount of parathion within a barn.

In general, the results of the 1954 tests and those of previous studies indicate that parathion is the most effective chemical tested for the treatment of cord for control of *Musca domestica* since it is the only impregnant to date which gives satisfactory control of insecticide-resistant houseflies for extended periods of 2-3 months. Indications are that air drying

Figure 5. Control of houseflies in rural areas with parathion-impregnated cords.



# Man's Emergence Toward Health

By HENRY VAN ZILE HYDE, M.D.

ONE of the signal honors of public health is an invitation to deliver the annual Winslow lecture. I am fully cognizant of this and deeply appreciative. All of us, I am sure, could tell of acts of friendship that have been extended to us by Professor Winslow and Mrs. Winslow, and we could tell, as well, of the stimulation and inspiration that we have gained from both of them. I had the good fortune to practice medicine in Syracuse, N. Y., a city known throughout public-healthdom as "A City Set on a Hill." I entered practice there shortly after Professor Winslow's book of that title was published, a book that revealed to me an exciting new area of interest and action, an interest which later became my career. So it is with a feeling of gratitude and warmest friendship, which has grown through the years, that I address you in honor of Dr. Winslow.

My title, "Man's Emergence Toward Health," may seem ambitious, but it grows from a feeling that builds up in one, unconsciously and quite inescapably, while traveling about the world in these days with an eye focused on health. We have tended to look at our business of public health as a small business, circumscribed by our own municipal environment, or, perhaps, our State or national environment, but since World War II public health has grown beyond these limits. There is a movement under way in health which constitutes one of

the great facts of our time, a force that is shaping world events now and for the long future. We as public health workers must recognize this force in our own field, understand it, and guide it, for any great force loose in the world today can be used to build freedom or, on the other hand, to build tyranny.

## Universal Swing Toward Health

The story of the development of public health in northern Europe and in the United States is known to most of you. It is a story told by the public health historians and particularly well, of course, by Dr. Winslow. As historians and philosophers view the progress of man, some see it as a slow upward crawling interrupted by frequent backward slippings. Others see it as a series of explosions, each related to some new basic discovery such as fire, cultivation, domestication of animals, the discovery of iron, or the harnessing of atomic energy. The development of public health appears to take this latter form, an explosion which, indeed, is modeled on the ultramodern design of the mushroom cloud—in shape but not in effect. The vertical stem of the cloud is the explosion in time—public health history. It is a very, very short history as you know, occurring almost entirely within two, or at the most, three generations of public health leaders.

Short as is the vertical stem of the public health explosion, we are witnessing today the equally dramatic lateral expansion of the mushroom cloud. Prior to World War I, public health activity in great areas of the world, if extant at all, existed mainly for the protection of the colonizing forces, for the governors of men, not for man himself. Today, in contrast,

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*Dr. Hyde, chief of the Division of International Health, Public Health Service, and United States member on the Executive Board of the World Health Organization, delivered the Winslow lecture at Yale University, March 28, 1955.*

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## Diabetes Control Courses in Boston

Four courses in diabetes control will be given at the Public Health Service Diabetes Field Research and Training Unit, Boston, Mass., for physicians, public health administrators, nurses, dietitians and nutritionists, social workers, health educators, and medical technicians. The courses for 1956 are:

*Patient education in diabetes*, designed for those concerned with individual and group instruction of persons with diabetes and with the families of these patients, will be given from February 27 to March 2. It is recommended for teams of workers. Membership for this course is limited to 12.

*Nursing aspects of a diabetes program*, designed for nurses in official and nonofficial health agencies, general and special hospitals and other institutions, clinics, schools, and hospitals, will be given March 19-23. Enrollment is limited to 15.

*The clinical and community approach to diabetes* will be given April 23-27 and again October 1-5. Planned for professional workers interested in diabetes programs, membership is limited to 20. Priority is given to applications from teams of staff workers from one agency.

*Nutritional aspects of a diabetes program*, given May 21-25, is arranged for dietitians and nutritionists in public and private health agencies, clinics, hospitals, and other institutions. Membership is limited to 15.

There is no fee for registration or tuition. The classes run from 9:00 a. m. to 4:30 p. m. daily. Part-time or intermittent attendance is not accepted. Application for admission to any one course should be filed as early as possible. Information about hotel accommodations will be sent after application is received. Further inquiries should be addressed to: Diabetes Field Research Training, 639 Huntington Avenue, Boston 15, Mass.

this disease whereas a recent survey following an intensive nationwide campaign showed only 0.03 percent of a sample rural population infected. Under the program presently being conducted in Indonesia, where there are an estimated 20 million persons infected with yaws, the target is 1 million examinations per month expected to reveal 83,000 clinical cases which will be given the required treatment.

The scope of the work that is under way is further attested to by the international program of vaccination against tuberculosis with BCG vaccine. Since 1947, while the experts have continued to debate the exact value of the vaccine, 101 million children, or approximately 10 percent of the world's children under 19 years of age, have been tested for tuberculin sensitivity, and 43 million of the negative reactors have been vaccinated.

Even in the face of such massive accomplishments, the expanding mushroom cloud of the health explosion would have little substance in the absence of a sound basic health structure. The availability of effectively organized and competently staffed national and local health services capable of thoughtful planning and able to reach the people is, of course, the essential ingredient of permanent accomplishment. Mass control of disease is pointless, except as a transient satisfaction, unless there are

services available to maintain the achievement. Therefore, the element of greatest significance in the present movement—that which Dr. Winslow would consider most fundamental—is the widespread establishment of such services.

Organizational progress both centrally and at the community level is being made in many countries. Eight of the governments of the Western Hemisphere have elevated their health departments to the rank of cabinet ministries within the decade. These ministries, as well as the health departments that exist elsewhere, are being manned to an ever-increasing extent by well-trained personnel. During the past 12 years, at which time the Institute of Inter-American Affairs gave the lead in establishing international governmental fellowships, more than 1,700 fellowships have been awarded to Latin American professionals by the institute for study of various phases of public health in the United States. During the years 1947-54 the World Health Organization awarded 4,356 foreign fellowships on a worldwide basis.

The flow of foreign fellows being placed by the Public Health Service under a variety of programs for training in the United States is shown in table 1. This is, of course, additional to the fellowship programs of the private foundations and of governments themselves. In

**Table 1. Foreign fellows programed by the Division of International Health, Public Health Service, 1951-55**

Area	1951		1952		1953		1954		1955		Total
	United States programs <sup>1</sup>	WHO <sup>2</sup>	United States programs <sup>1</sup>	WHO <sup>2</sup>	United States programs <sup>1</sup>	WHO <sup>2</sup>	United States programs <sup>1</sup>	WHO <sup>2</sup>	United States programs <sup>1</sup>	WHO <sup>2</sup>	
Western Hemisphere.....	46	14	53	32	111	36	135	44	134	40	645
Europe.....	88	6	94	25	65	50	21	16	27	20	412
Near East, Africa, and Southeast Asia.....	23	10	85	17	95	21	81	16	98	10	456
Far East.....	93	10	154	28	274	31	288	27	247	30	1,182
Total.....	250	40	386	102	545	138	525	103	506	100	2,695

<sup>1</sup> Includes Mutual Security Administration, Technical Cooperation Administration, Institute for Inter-American Affairs, Foreign Operations Administration, European Cooperation Administration, International Cooperation Administration of the Department of State as well as programs under High Commissioner of Germany, Supreme Commander Allied Forces in the Pacific, Public Law 759, 81st Cong., 2d sess. (government and relief in occupied areas), Public Law 265, 81st Cong., 1st sess. (Finnish war debt), and Public Law 402, 80th Cong., 2d sess. (Smith-Mundt Act)

<sup>2</sup> The Public Health Service assists in programming only a part of the total number of WHO fellows in this country.

we see a profound and universal swing toward health for all men who people the world.

Evidence of man's explosive emergence toward health is seen in the current mass attack on communicable disease in the underdeveloped areas, in the widespread development of increasingly competent national health services, in the establishment of extensive networks of rural health centers and in the intensification of international action in the health field.

One of the most impressive and significant phenomena of our times is the mass control of certain diseases, even to the point of eradication in vast areas. The reality of this accomplishment strikes one with great impact on visiting the affected areas of the world: the scope of it is tremendous.

In 1948 the incidence of malaria was estimated at 300 million cases per year. Recently, the World Health Organization has announced that 243 million, or almost one-half of the 552 million people living in malarious areas, are now protected against malaria. In dealing with such figures we are speaking of one-fifth of the population of the entire world. In India 125 million of the 200 million persons exposed to malaria are now protected. Italy, Greece, Iran, Thailand, Ceylon, the Philippines, Formosa, Venezuela, and Brazil are among the countries that have taken similarly important strides in this field. The nations of the Western Hemisphere, not satisfied with mere control of this disease, decided in Santiago, Chile, in October 1954 to act in concert actually to eradicate malaria from the entire hemisphere, and it is anticipated that this astounding feat can be accomplished within the next 8 years. Likewise, a recent World Health Organization malaria conference held in the Philippines resolved that eradication, rather than control, must be the objective in Asia.

On a somewhat lesser scale, yaws, which is a particularly crippling and disfiguring chronic infection, presents a similar example of accomplishment in mass disease control. Within the last 6 years 35 million people have been examined for yaws, and 8 million have been treated. As recently as 1950, 50 percent of the total population of Haiti and an even higher percentage of its rural population suffered from



PHILIPPINES—A nurse from a rural health center visits a barrio under her jurisdiction. Her work and that of others like her is slowly replacing the work of the *herbolarios* and primitive jungle practitioners.



PHILIPPINES—A rural health specialist points to a demonstration area where Philippine personnel are being trained for service to families residing in remote areas of the islands.

number of countries—either as separate health plans, as in the case of the \$75 million 5-year health plan in Iraq, or as a major segment of a general development plan, as is the case in Iran, India, and Pakistan.

The far-reaching character of the present movement in health is evidenced best by the rapid expansion of networks of urban and rural health centers which are penetrating remote areas and blanketing much of the world. While providing varying degrees of medical care, which they must in the areas in which they operate, they are increasingly providing preventive services with trained auxiliaries assisting the professional personnel. Quite surprisingly, it is not possible to find and present any substantial data on this dramatic development; even the nomenclature is muddy. There is in this a serious gap in our knowledge that needs to be closed. The spotty information that can be found is presented in table 2. Increasingly, such centers are becoming integrated into total community development programs, which encompass services designed to improve agriculture, education, and the total village economic and social structure. At the moment

this desirable trend is conspicuous, particularly in Mexico, Egypt, and India.

International cooperation, as a field of action, presents dramatic evidence of the momentum of the health movement on a world basis. Before World War II there was limited activity in international health carried on by the International Office of Public Health in Paris, the Pan American Sanitary Bureau in this hemisphere, and the League of Nations health section, the work of these organizations being, at that time, restricted almost entirely to the international exchange of epidemiological information.

However, the League of Nations did embark, in a small way but with great vision, on programs for the development of international standards for drugs and biologicals, the improvement of health statistics, the development of standards of human nutrition, and the provision of technical assistance to governments in the development of their own health services. Through its survey and advisory health missions to Greece, China, Bolivia, and other countries, it became the pioneer in the field of international technical assistance which has expanded so greatly in many fields since World War II.

### Emergence of WHO

From these origins sprang the World Health Organization. It is not the world equivalent of the health department located in the cellar of the county building. From the standpoint of membership of sovereign nations, the World Health Organization is the largest official international structure ever built by man, with a membership of 80 states as compared with the United Nations, for instance, which has a membership of 60 states. Staffwise, with 1,307 employees, it is the largest agency within the United Nations orbit, except for the United Nations itself. On the world scene, therefore, health is, today, one of the "big shots" of inter-governmental action. This represents explosive progress.

The health budget of the League of Nations never exceeded \$400,000, of which only \$200,000 was contributed by governments. During the interwar period the total annual governmental

several of the countries, such as Brazil, Mexico, Chile, and Lebanon, training is being bolstered by new schools of public health that have been established or, as in the case of the Philippines and India, old ones that have been recently strengthened.

New and essential basic organizational units, such as divisions of public health nursing, environmental sanitation, sanitary engineering, health education, vital statistics, training, planning, and so forth, are being established within health departments and ministries. Twenty-three of thirty-seven of the less highly developed countries, for instance, today have a nurse serving in the ministry of health at the national level as shown below:

**Nurse at national level:** Brazil, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Formosa, Haiti, India, Indonesia, Iraq, Israel, Korea, Lebanon, Liberia, Mexico, Panama, Paraguay, Peru, Philippines, Thailand, Uruguay, Venezuela.

**No nurse at national level:** Afghanistan, Bolivia, Ecuador, Egypt, Ethiopia, Guatemala, Honduras, Indochina, Iran, Jordan, Libya, Nepal, Nicaragua, Pakistan.

It is of particular significance that the first category includes a number of countries in which women were in deep purdah until very recently. The demonstrated value of nursing has over-ridden the prejudices and attitudes of many ages.

As part of the development of more effective services, there is a movement toward the progressive decentralization and expansion of health administrations, bringing them into closer relationships with the people they are designed to serve. Such movements are particularly conspicuous at the moment in Iran, Iraq, the Philippines, Brazil, and Mexico. Rather extensive formalized plans covering various periods, usually 5 years, are under way in a

Table 2. Rural health centers in certain countries

Country	Population <sup>1</sup>	Type and number of centers
Thailand.....	20, 000, 000	720 rural health centers. 91 first class (physician, nurse, etc.). 629 second class (sanitary inspector, midwife). 153 rural health centers.
Egypt.....	21, 935, 000	151 rural social centers with health services. 80 child welfare centers with health services.
Philippines.....	21, 440, 000	956 rural health units (all types, various stages of staffing). 81 demonstration rural health units of United States type.
Indonesia.....	78, 163, 700	2,432 government polyclinics. 234 private polyclinics.
Pakistan.....	75, 842, 165	188 rural health centers. 344 rural health stations.
Taiwan.....	8, 617, 000	22 county health centers. 3 rural health centers.
Haiti.....	3, 227, 000	3 large mobile health units (Caspian region, Teheran, Tabriz). 8 completely equipped demonstration health centers from which operate 25 small mobile units.
Iran.....	20, 253, 000	5,840 rural dispensaries. <sup>2</sup> 1,695 urban dispensaries. <sup>2</sup>
India.....	372, 000, 000	1,950 official public health services: 1,280 general. 670 specialized.
Brazil.....	57, 098, 000	103 health centers (physicians, nurses, etc.). 306 health stations (sanitary inspector). 15 mobile units.
Colombia.....	12, 108, 000	1,277 rural health services: 528 centers of hygiene and medical care 463 clinics of medical service 163 dispensaries 103 first-aid stations 20 vaccination offices.
Mexico.....	28, 850, 000	123 polyclinics. 18 departmental clinics. 29 auxiliary clinics.
Uruguay.....	2, 525, 000	

<sup>1</sup> From United Nations Statistical Yearbook, 1954.

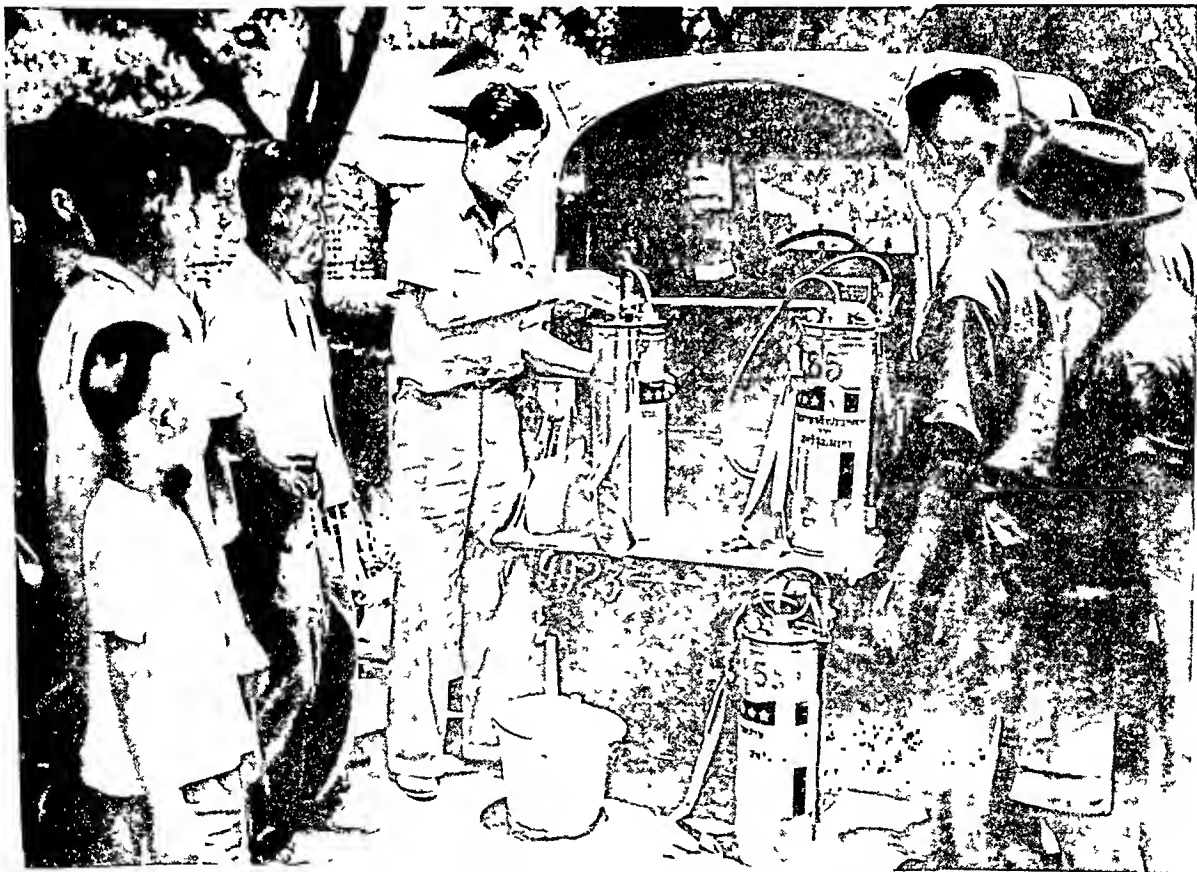
<sup>2</sup> Provided for in 1955-56 plan.

effect. It has been clearly demonstrated, however, in the relatively recent era of scientific public health that widespread and oppressive diseases can be controlled in a predictable way. The miracles of immunology and sanitation have been followed by those of DDT and penicillin. These have occurred concurrently with the widespread development of communication and transport, which has spread the message widely.

The extent to which news penetrates to remote places is perhaps not generally understood. The blaring of a public radio in the town square or at the main crossroad has become characteristic in poor and primitive population centers. It is not necessary to be literate, or to be able to afford a radio set or even the day's paper in order to keep in direct touch with world affairs. Further, remote areas are being opened up through the extension of farm-to-market roads and through the routine use of

air transportation. The airplane has knitted together the scattered and isolated towns in such mountainous countries as Honduras and Colombia. President Tubman of Liberia now carries government, for the first time, into the remote bush through personal visits in a light plane. The Indian Health Service of Canada utilizes the airplane to provide regular service in the vast tracts of the north. This new nearness of man to the foci of progress has fed the desire for better health.

Since any desire shared by a significant number of people constitutes a political force, it is apparent that the widespread urge for health manifest today is a highly potent political force demanding action. Its intensity is heightened in countries that have recently attained independence because self-rule is associated in men's minds with a good life. Why, otherwise, fight for it?



THAILAND—Assistant director of a malaria control unit demonstrates mechanism of spray guns.



HAITI—Yaws patients wait for treatment at a clinic.

contribution to international health work, including contributions to the International Office of Public Health in Paris and the Pan American Sanitary Bureau, never reached \$300,000, with the United States, which was not a member of the League, contributing only \$6,000 to the world program and \$60,000 to the hemispheric one each year.

This provides some measure of the extent of governmental interest in health so short a time ago. In contrast, the World Health Organization budget, financed entirely by contributions from governments, is now at the level of \$10 million. In addition, WHO gives leadership and direction to health programs it undertakes jointly with the United Nations Children's Fund and the United Nations Technical Assistance Program. Its total annual resources, direct and indirect, are, therefore, in the neighborhood of \$15 million.

Governments established the World Health Organization because of their recognition of the need for international cooperation and assistance in health, yet, in 1948, when the World Health Organization stepped onto the world stage and offered technical services to governments, there were few takers. Most governments wanted supplies and nothing less tangible. The scene has changed rapidly with the growth of understanding, and today the World Health Organization has technicians in almost every country in the free world. In 1954 alone,

it was engaged in 329 major projects in 75 countries. Its most pressing problem is that of meeting from its available resources the requests that flow in.

The World Health Organization activities represent common action through international pooling of resources and skills. The United States is supplementing these activities by conducting a cooperative international technical assistance program in health, which is administered by the Foreign Operations Administration with the support of the Public Health Service, the universities, and other private agencies. (On July 1, 1955, the Foreign Operations Administration was abolished, and its technical assistance activities taken over by the International Cooperation Administration of the Department of State.) This is the program widely known at one time as point 4, which has a health component operating at a level of \$26 million per year. Taking this into account, the total contribution of the United States to international health work, made directly and through the international agencies, now ranges around \$40 million. This is a far cry from the \$66,000 of only 10 years ago.

### The Demand for Better Health

Recognizing that there has been a great acceleration in the tempo of health development, one wonders what the underlying factors are that have brought it about. The fundamental factor is a demand from the masses for better health, growing from the demonstration that health can be obtained at a reasonable cost through techniques now available. The realization that ill health is avoidable has penetrated to the remotest areas, creating a political force of local, national, and international significance.

The demand for health is based fundamentally, of course, on the innate animal desire for relief from pain and suffering and the equally innate instinct to protect one's offspring. Through the milleniums, efforts to modify pain and suffering have been made through sacrifices to many gods, through attempts at avoidance by haruspicy, through incantations and the taking of strange mixtures. None of these efforts had a consistent



here and abroad. The relationship of health to economic development, which has been so clearly set forth by Professor Winslow and dramatized particularly by the modern story of malaria, has attracted the thoughtful attention of those who shape world affairs and has given health work much of its present momentum.

A lesser factor contributing strength to the international movement in health is the fact that protection against exotic disease in the face of modern transportation speeds has required a positive approach rather than the negativism of traditional quarantine. This positive approach has taken the form of international assistance in the control of disease at its source. In his account of Mr. Barr and the innocent introduction of smallpox into the United States, Dr. James S. Simmons has given us in "Public Health in the World Today" a compelling story of the need for this approach.

As contrasted to narrow nationalism, the growing recognition of the world as an essential whole provides the milieu within which health action spreads rapidly and widely without too great reference to artificial boundaries. Inter-relatedness has replaced isolation, and there is a true sense of mutual responsibility for the state of the world at large.

In the free world, this sense of mutual responsibility is not motivated by political or economic opportunism alone. Much deeper and more meaningful forces underlie today's internationalism. The moral concepts that have shaped our own American freedom are known throughout the world and are inspiring today's movements toward freedom. The Declaration of Independence is not solely a United States document but a world platform; Lincoln is not a local figure but a world hero and a universal symbol of faith and hope. We can easily recall how the Atlantic Charter and its four freedoms electrified us only a few years ago. We wish to make good on those promises.

We cannot indeed sidestep moral responsibility for preventing disease because we know, with Thucydides, that "the true author of the subjugation of a people is not so much the immediate agent, as the power which permits it, having the means to prevent it." And we are

the ones who have the means to prevent disease.

The moral drive underlying international action does not stem solely from political philosophies or from guilt but from a deeper root that underlies philosophy and guilt. It is perhaps a fortunate thing that the power and the wealth and a large measure of the greatly needed technical skills are in the hands of those whose religion drives them to share their substance. The medical missionary is a forerunner in spirit, more than in technique, of the official international programs in health.

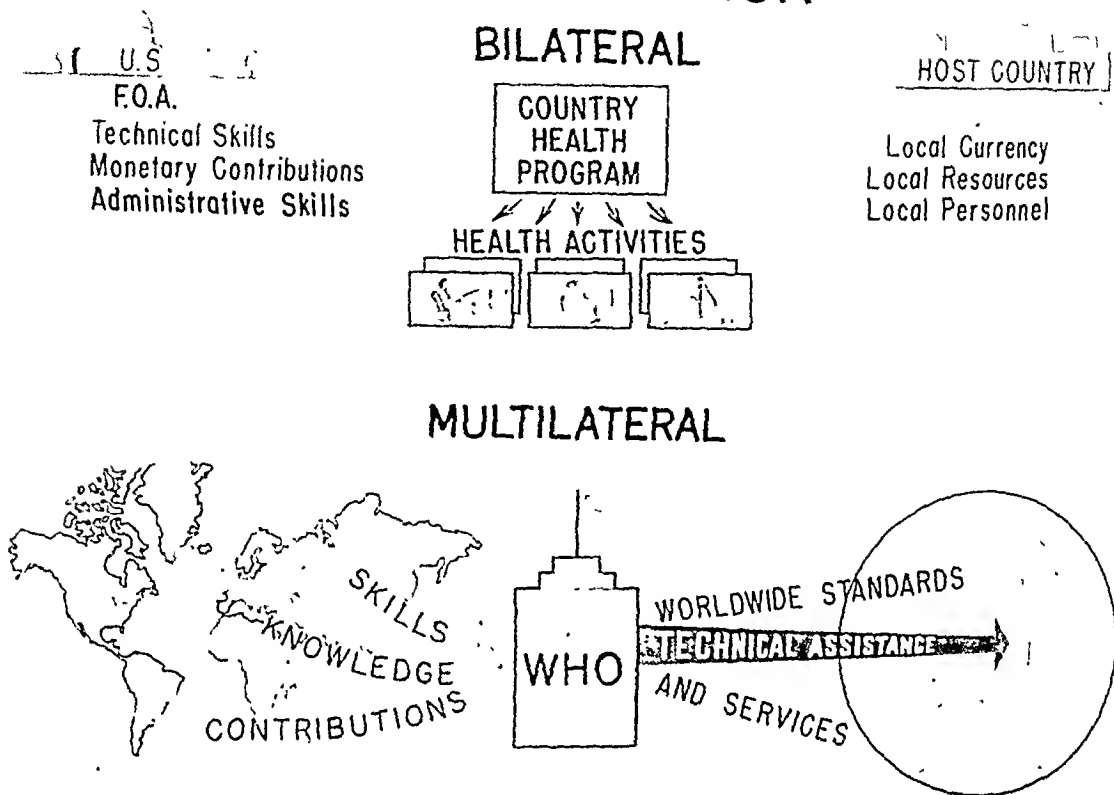
Where can we derive more immediate satisfaction of our moral urge than in the field of health, sharing our resources in order to solve the massive immediate human problem touching every man? Freeing man from the burden of disease so that he might have flight of spirit satisfies the requirements of today's moral urge as well as any immediate material goal. Whether programs are labeled health, agriculture, economic development, or technical assistance, the improvement of man's daily life is their goal, and, directly or indirectly, they must bear upon man's health.

All of this is of particular importance to us as workers in public health. We cannot think of peace as a problem solely for the diplomat or the statesman, nor of economic development as a problem for the economist alone. The emergence of man toward health constitutes a fact of our times within our own sphere of responsibility that is very truly affecting the future of mankind. India will never again be what it was yesterday, nor will Brazil, nor Mexico, nor Haiti, nor Indonesia, nor any country in the so-called underdeveloped belt.

We, as professionals in the field of health, have the primary responsibility for assuring that this great force, which is expressing itself with explosive rapidity, is utilized to the fullest extent in the furtherance of freedom and the establishment of peace. It is incumbent upon us not only to recognize it but to understand it much more deeply than we do today. As in the case of any great force, it can be used well or badly for good or for evil. Its proper use is our particular and inescapable world responsibility. May we discharge it wisely and for the betterment of all mankind.



# PATTERN OF COOPERATION



Such different men as Magsaysay, Nehru, U Nu, Mohammed Ali, Sockarno, and Kotelawala, who in common are leaders in newly independent countries, have initiated extensive national activity in health in a conscious effort to satisfy this expectation. Others, new in power, in countries with a long tradition of independence, such as Pibul Songgram in Thailand and Paz Estenssoro in Bolivia, have likewise stepped up health activities with a view to achieving stability and combating subversion. The communists utilize this same force in order to accomplish their ends. John Ridley, who accompanied Clement Attlee on his visit to Red China, has reported at some length in the *New York Times Magazine* (August 29, 1954) on the manner in which health is being employed to strengthen the hand of the present government there.

Internationally, the same political factor is at work. Here it is a matter of the cumulative force of the health demands of the total of the world's population. As the antipodal forces of

freedom and tyranny clash on the world scene, each is trying to gain the adherence of the masses and using either health promises or performance as one means of doing so. We, for our part, have promoted and supported health measures through the World Health Organization, the Pan American Sanitary Bureau, the United Nations Children's Fund, the International Cooperation Administration, and the Colombo Plan for Cooperative Economic Development in South and Southeast Asia. On the other side, it has been largely a matter of false promises.

It is a generally accepted tenet of modern political philosophy that peace can survive only in the presence of economic growth and stability. There is increasing acceptance of the additional fact that a sound economy cannot be built upon a sick population. Professor Winslow has made a major contribution to this area of thought in his monograph on "The Cost of Sickness and the Price of Health," which was published in 1951 by the World Health Organization, and which has had wide influence

eyes, the tone of their voice when they mention their father—these are not statistics. They transcend cold, hard facts and figures.

The young man who didn't complete his schooling because, a generation ago, his father died of tuberculosis has finally worked up to a decent job, has married and had his first boy, and is now told that he, too, has tuberculosis. But, it is early and minimal, because it was picked up by a mass survey before he became ill. A fine hospital with excellent medical care is freely available to him. A public health nurse will help his physician check his family and will help carry out a home care regimen prescribed by his physician after a shortened hospital stay. We know, and he knows, that his chances of returning to his family and his job within a reasonable length of time are excellent.

These are the human values we are dealing with day in and day out. Let us not move so far away from them that we, or any one else, will be allowed to think of public health only in terms of statistics or dollars.

### Applied Principles

The principles we are applying in a stepped-up program of health protection for Pennsylvania are many.

First, we accept the fact that optimum communitywide prevention of disease is not a one-man or a one-agency affair. Three links are needed to forge the chain, each one equally vital: the individual, who must be given the knowledge of, and willingness to accept, what modern medicine can offer him; the private physician, the first line of defense against many diseases, who should provide community leadership in all health programs; and the health agencies, official and voluntary, which can do those things not possible individually but effective on a group or community basis. It has been used so much that I hesitate to label public health a "team" affair. But, with the complexity of our social and industrial structure and with the variety and costliness of health protective techniques now available, it most certainly requires the best efforts of all—working together as closely as we can—to do the most nearly complete job.

Second, we have accepted the increasingly important role played by health education in today's public health practice. Health education stands in the same paramount position now as sanitation did 50 years ago. It presents our best weapon against the chronic diseases now most prevalent, just as sanitary measures provide a continuing bulwark against the gastrointestinal diseases.

Our task is not simple, for information is not enough. We must learn how to break down "sins" which beset us all—lethargy, rationalization, and misinformation. Probably no area of discussion, not even the weather, has been so long and thoroughly explored as our physical and emotional ills. Yet we have only to consider the folklore which has been built up around one disease, poliomyelitis, to highlight our difficulty. Much misinformation must be dispelled, much wishful thinking replaced by openmindedness, before we can begin to arouse folks from their complacency and stimulate useful action. This will take time, training, and tenacity.

Third, we accept the proposition now repeatedly proved across the land that health services as nearly indigenous as possible are the most effective. Pennsylvania has, and always should have, broad responsibilities to see that the health of its people is protected. It will probably always be far more economical and efficient to have a central staff of experts in the various health fields to prepare standards and devise general programs.

But only as counties and health districts begin to participate in both supporting and providing the services they need to protect their health will those services be best tailored to each community's needs and be best accepted by its residents.

Only two counties have used the 1951 permissive legislation to establish local health departments. Many more are seriously exploring the possibility. What do county departments of health offer these areas now considering this extension of health protection? They offer more local determination of service priorities based on greater sensitivity to local needs; qualified medical leadership in public health, which in turn means closer coordination with

# Public Health in Pennsylvania

By BERWYN F. MATTISON, M.D.

OUR changing attack on disease is necessitated by changing community disease patterns. To provide new and extended forms of health protection for the people of Pennsylvania, we have asked for support of services of proved efficacy and for limited demonstrations to provide effective health protection techniques where none are now available. Without that support, the people will die needlessly.

## A Purchasable Commodity

It has been said that "public health is purchasable," and that statement is still true. If those who might be tempted to "economize" on health could but know the human details of the resultant personal misery, they would hesitate no longer. This understanding is no matter for statistics. Even words are inadequate!

To appreciate the real value of what we do in public health one must experience the moments of anguish, as so many physicians and nurses present today have, when a mother is told that her tiny daughter, born a few hours or days prematurely, has not survived—and know, within his heart, that with very special care,

she might have lived. Or, one must have had the responsibility of telling parents that their apparently healthy boy has epilepsy and feel keenly that much could be done for him that may never be done.

I have seen an otherwise attractive little 9-year-old girl hiding behind a packing box and peering wistfully out at other children because her unrepaired harelip was a thing of laughter and ridicule among them. Yet, Pennsylvania has one of the best programs in the Nation for that kind of care. I have looked into the eyes of a still feverish child who was running and playing a week ago and evaded the answer to her unspoken question as she tried to move a leg made limp by poliomyelitis and wondered if our present local health services are geared to assure every child in the State the new protection available.

How many of us have cared for cancer patients—heard them tell of their families and their plans for the future—when we knew full well that, through lack of information, or diagnostic facilities, or willingness to accept early treatment, they had already traded a probable cure for certain tragedy? Not only statistics but a sense of personal values should indicate universal support for our programs.

The estimated number of Pennsylvanians suffering from chronic alcoholism is staggering. The dollar loss to industry, year after year, is appalling. But the real enormity of the problem only hits us when we think of our friend and neighbor, Joe Doaks, who had a good job, a home, and a happy marriage with two fine children. Before help was provided, he had lost his job, his home, and the respect of his wife and children. The look in those children's

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*Dr. Mattison, secretary of health of the Commonwealth of Pennsylvania, presented this paper at Pennsylvania's Fourth Annual Health Conference, held August 16, 1955, at University Park, Pa. In Pennsylvania, the health conference pattern provides for full participation of four autonomous groups: the Pennsylvania Department of Health, the Health Council, the Medical Society, and the Public Health Association.*

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# Epidemiological Tests of Theories on Lung Cancer Etiology

By WILLIAM HAENSZEL

QUESTIONS on the etiologies of lung cancer cannot be resolved by a single, decisive experiment or set of observations, and a single study is not the natural unit for discussing the epidemiology of this disease. The major concern must be with the interrelationships of findings and their collation to see whether a chain of evidence stronger than any single component part can be forged. Information on a proposed etiology cannot be assessed without relating it to both positive and negative findings on alternate possibilities, drawn from animal experimentation and other laboratory work as well as from epidemiological studies. Also, with a subject under such active scrutiny as lung cancer, it is difficult to attempt to divorce facts already established from interpretations which may either be stated explicitly or merely be implied by investigators through their choice of specific studies to be pursued. Under these conditions, a better perspective on epidemiological issues in lung cancer studies may be gained by viewing them in the perspective of possible future work. Since interrelationships of individual findings are the main concern, this paper

deals more with the ideas underlying a set of studies than with the tactical details of any single study.

## Increase in Lung Cancer

If no real increase in lung cancer existed, all associations between lung cancer and exposure to atmospheric pollution, cigarette smoking, or other exogenous agents recently introduced into the environment would be suspect as not pointing to possible etiological relationships. A few persons still maintain that the recorded increase in lung cancer incidence and mortality is fictitious and has resulted from improved diagnosis (1), but this is no longer a popular position (2). Among the reasons for accepting a real increase in lung cancer mortality are the sex differences in rate of increase and the magnitude of the current, continuing increase (3).

One purpose for inquiries on the increase in risk would be to provide more precise quantitative estimates than are now available from mortality data which may later prove useful for reconciliation with numerical measures of exposure to suspected agents. For this reason, anyone proposing to study the effect of possible misdiagnosis of lung cancer as tuberculosis (4) or some other cause should relate these effects to data produced by the death registration system. Samples of deaths from lung cancer and other causes taken from vital statistics sources could be compared with autopsy protocols and other diagnostic evidence. Evaluation of the

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*Mr. Haenszel is head of the Biometry Section, Biometry and Epidemiology Branch, National Cancer Institute, Public Health Service. He presented this paper at a joint session of the Biometrics Society and the Institute of Mathematical Statistics, Chapel Hill, N. C., April 23, 1955*

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the clinical practitioners and increased interest on their part in preventive medicine; a broader tax base for the support of health services; and more readily available local services, whether they be nursing, immunization, sanitation, or health education.

As county departments spread across the State, many of the direct service functions now provided out of Harrisburg can be cut down proportionately. Supervision and correlation will, of course, be continued through district and regional offices.

Fourth, we accept the need for continually evaluating our programs. This is not easy, and we are inclined to give the concept lipservice rather than to work out real evaluations. There are at least three levels on which a program can be tested for its worth: the degree to which it meets a short-range, immediate objective such as reduction in complaints after correction of an overflowing septic tank; or the degree to which the program complies with established standards of acceptable performance such as the percentage of employees in a department having permanent merit system status; or finally, the degree to which a program can be associated in a cause and effect relationship with decreased morbidity and mortality rates. But whether our program tests are at the proximate, intermediate, or ultimate levels, some tests must be

made, and year by year they must be improved. One of the immediate tests we might apply is to check our services against the health indexes of the people served.

We can observe vast differences in these health indexes. For example, our best 3 cities, as far as infant deaths are concerned, have an average infant death rate of 3.1 per 1,000 live births, but our poorest 3 cities have an average death rate of 14.6. This means that for every 15 baby deaths in one kind of community the other community has only 3. Are we putting in proportionately greater efforts to reduce the latter toll? Our best 5 cities have an average tuberculosis death rate of 2.6 per 100,000 population, but in our worst 5 cities we have an average rate of 20.3. So, for every 20 tuberculosis deaths in one kind of community there are less than 3 in the other. Our intensified efforts should be focused on the area with the greater need.

With these principles in mind, teamwork, health education, local autonomy, and evaluation; with adequate financial support from our appropriating bodies; and with the continued selfless dedication to the cause of better community health on the part of every one of us, we will together decrease each year the number of those among us who have been dying needlessly.

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## Mental Health Admissions

There were more than twice as many first admissions as discharges at public mental hospitals in 1954, according to the National Institute of Mental Health, Public Health Service.

New cases numbered 12,485, or 8 per 100,000 population, while 5,815 patients were discharged and 1,026 readmitted. The average daily patient load, including epileptics as well as mental cases, was 138,595, with 109,931 classed as mental defectives. The range of expenditures for patient care varied considerably among the States, but the average cost per patient-year was \$1,039. Of the 157,770 patients on the hospital books at the end of the year, 139,977 were listed as in residence.

Data compiled by the National Institute of Mental Health for 1955 will appear in the forthcoming issue of *Public Health Reports*.

such as industrial and heating plant wastes and motor vehicle exhausts.

### Atmospheric Pollutants

To date, atmospheric pollution theories have not been well documented by demonstrations of excess risk among workers with heavy exposures to common atmospheric pollutants such as may exist in railroad yards, oil refineries, and congested urban areas. With the advent of group insurance and pension plans, the methodological problems of such inquiries have become much simpler. Several cohorts can be located for study. The National Cancer Institute is following a group of 1,100,000 railroad employees who have been in the industry 10 years or longer, including station, office, yard, and shop employees, as well as train crews. Rather detailed occupational histories are available and, with the accumulation of mortality data over several years, such specific points as the effects of dieselization, prolonged exposure to smoke in railroad tunnels, and metal dust exposures in shops may be looked into. The important feature is that work histories and exposures be specified in some detail. Significant effects may be diluted and overlooked by considering only gross company or industry experience.

The widespread use of petroleum products makes it very desirable to gather data on workers in that industry. Some medical departments of the major oil companies have staffs well equipped to undertake such studies. The major problem here, as elsewhere, is to secure access to company records and to rearrange data organized to meet other administrative needs. In areas where petroleum operations are concentrated, data might be collected on a geographic rather than an industrywide basis. At least one study is under way in Oklahoma which may yield some information on lung cancer risks among oil industry employees.

Those advancing atmospheric carcinogen theories have pointed to the sizable urban-rural differentials in lung cancer risk (14), although some further assumptions are required to reconcile this hypothesis with the great excess risk observed among males. The presence of carcinogenic substances in urban atmospheres has been repeatedly demonstrated by experi-

ments with mice (15, 16). Further epidemiological work has been hampered by the inability to classify individuals in the general population quantitatively with respect to atmospheric exposures. Meaningful histories are hard to collect, and in mobile populations, problems of classification by residence histories become complex. When leads on specific types of atmospheric pollutants are obtained from studies of special situations, the way may then be opened for return to the problem of reclassifying the general population with respect to special exposures with greater chance for success.

### Smoking of Tobacco

Although at least 14 retrospective clinical studies (17) have reported on the association of smoking and lung cancer, these studies have been criticized on a variety of technical grounds. The objections advanced cover such points as interviewer bias (interviewers in some studies knew the identity of lung cancer patients and controls at the time of interview), and bias arising from selection factors associated with hospital admission (in most studies only hospitalized lung cancer patients were interviewed). However, the objection based on knowledge of the identity of patients and controls ignores the evidence of Doll and Hill (18) that males erroneously interviewed as lung cancer cases, as established by later events, showed smoking histories characteristic of the control rather than of the lung cancer series. Because of possible selection factors involved in taking up the smoking habit, some feel that the tobacco-lung cancer associations reflect associations with other common, but still unidentified factors.

The present data on associations between smoking and lung cancer are the most extensive and afford the most opportunities for discussing additional studies. For orientation, the type of evidence now on hand may be compared with the epidemiological findings for cholera, pellagra, and dental caries, all diseases in which animal experimentation played a minor role, at least in the early phases of the investigation (19-25).

On review, the basic core of associations on smoking and lung cancer must appear as impressive as any produced in these other investi-

two sources of error in official statistics, (a) deaths from other causes erroneously recorded as lung cancer and (b) lung cancer deaths attributed to other causes, would be rendered difficult by the selective character of autopsy statistics. However, the effort should be made. A useful minimum objective would be to determine how many lung cancer cases remain undiagnosed at present. Farber reported that in a series of 1,070 morphologically proved cases of bronchiogenic carcinoma, 61 percent were not positively diagnosed prior to autopsy (5). Undoubtedly, many of these deaths were not recorded as lung cancer on the death certificate.

### Environmental Agents

The working hypothesis for most investigators has been that the probable causes of lung cancer are to be found among environmental agents (2). The association of the high prevalence of cancers for several other sites, particularly the mouth, with specific customs found only in certain parts of the world strengthens the belief that direct contact with known or suspected carcinogens may be involved (6). On the assumption that agents with opportunity for direct contact with lung tissue are the most likely candidates, efforts to establish etiological relationships between lung cancer and environmental agents have been directed into three main areas: (a) airborne agents encountered in special occupations; (b) atmospheric pollutants, particularly those resulting from combustion of hydrocarbons; and (c) smoking of tobacco.

To assert that an agent is etiological related to lung cancer simply implies that its removal from a defined population will result ultimately in a marked reduction of lung cancer. The population must be defined in a manner which safeguards against an effect being produced merely by the process of selection and classification. The concept does not require detailed specification of a mechanism producing the effect. Goldberger's finding that pellagra may be prevented by diet was no less valid because subsequent work led to the identification of the vitamin B complex and, finally, to nicotinic acid as the effective agent. This statement does not imply that ideas on mechanisms

are not helpful; to the contrary, they may suggest situations in which data can be collected and tested.

### Occupational Carcinogens

There is general agreement on the etiological significance of several occupational exposures, and such findings have been important in establishing the principle of multiple etiologies for lung cancer. Long-term observations of closed populations have convinced most people that the Schneeberg and Joachimsthal miners (7, 8) and certain groups of chromate workers (9, 10) were subjected, by virtue of their occupations, to excessive lung cancer risks. The evidence on chromate workers is purely epidemiological, not confirmed by animal experimentation, and was first suspected on the basis of clinical observations. Although many investigators have deduced from the Schneeberg and Joachimsthal observations that radiations emitted from radon were responsible, Lorenz felt that the case had not been firmly established and that other possibilities, such as dust pneumoconiosis, had not been conclusively ruled out (11).

Excess lung cancer risks detected by examination of occupational mortality data, such as data on workers employed in the preparation of coal tar products and producer gas (12), have also been generally accepted as reflecting an etiological relationship between lung cancer and some suspected carcinogenic agent in these products. Nor is there any great disposition to question the status of agents detected by clinical observations and retrospective studies of agents such as arsenic dust, nickel carbonyl, asbestos dust, and coke oven fumes (13). When the study results are reviewed to pick up occupational exposures which appear repeatedly, the danger of being misled by a highly unusual result in a single study is minimized. Additional occupational risks will no doubt be demonstrated in the future. However, because of the small numbers of workers exposed, the further denumeration of very restricted types of risks will not be crucial in working out the epidemiological details of lung cancer. This statement would not apply to the common and widespread agents contributing to atmospheric pollution, including hydrocarbon combustion products

such as industrial and heating plant wastes and motor vehicle exhausts.

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To date, atmospheric pollution theories have not been well documented by demonstrations of excess risk among workers with heavy exposures to common atmospheric pollutants such as may exist in railroad yards, oil refineries, and congested urban areas. With the advent of group insurance and pension plans, the methodological problems of such inquiries have become much simpler. Several cohorts can be located for study. The National Cancer Institute is following a group of 1,100,000 railroad employees who have been in the industry 10 years or longer, including station, office, yard, and shop employees, as well as train crews. Rather detailed occupational histories are available and, with the accumulation of mortality data over several years, such specific points as the effects of dieselization, prolonged exposure to smoke in railroad tunnels, and metal dust exposures in shops may be looked into. The important feature is that work histories and exposures be specified in some detail. Significant effects may be diluted and overlooked by considering only gross company or industry experience.

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The present data on associations between smoking and lung cancer are the most extensive and afford the most opportunities for discussing additional studies. For orientation, the type of evidence now on hand may be compared with the epidemiological findings for cholera, pellagra, and dental caries, all diseases in which animal experimentation played a minor role, at least in the early phases of the investigation (19-25).

On review, the basic core of associations on smoking and lung cancer must appear as impressive as any produced in these other investi-



gations. However, lung cancer does not present the features of geographic localization characteristic for cholera, pellagra, and the absence of dental caries, which made it possible to elaborate in a rather straightforward manner the basic associations with water supplies suspected of contamination (cholera), diet (pellagra), and fluoridated water (dental caries) with corroborative detail and combinations of isolated special situations. Such detail is helpful in ruling out some association as not significant etiologically; in this manner, for example, the associations between cholera and altitude (within London) and between pellagra and mill village occupations could be discarded as not significant. For lung cancer, there are as yet no counterparts, for example, to the cholera patient in an isolated rural area who regularly sent for water from the famous Broad Street pump (19); to the absence of pellagra among doctors, nurses, and attendants in mental institutions, although the disease was common among patients; to the peculiar age distribution for pellagra in a children's institution where the disease was limited to children between the ages of 6 and 12; to differential attack rates for dental caries by gradations of exposure to fluoridated supplies among natives and immigrants; and to the sequence of dental events following shifts in the source of a community water supply. Collection of such details generally results from the study of populations. This is one of the reasons why forward studies on lung cancer among defined population cohorts are so important.

Furthermore, the epidemiological models for cholera, pellagra, and dental caries have been put to the test in the successful application of control measures. For pellagra, only the addition of meat and milk to the diet was involved (26). Fluoridation effects could be observed under controlled conditions because of the happy accident of public water supplies; if private wells were the only source of water, the problem would have been complicated by self-selection of families fluoridating their own supplies. The test of Snow's conclusions on cholera (19), which required implementation through administrative decisions on methods for control of public water supplies, occurred

much later, more than 10 years after he had formulated them.

The right combinations of circumstances to permit such straightforward tests of most of the proposed lung cancer etiologies are not present now. Thus, the immediate lines for further work on the nature and meaning of the smoking lung cancer associations are to develop reasonable facsimiles to tests by control measures and to assemble supporting, corroborative detail from population studies, not overlooking any negative evidence which may appear.

### **Substitutes for Direct Tests**

As a substitute for a direct test by control measures of the smoking-lung cancer model one may look for groups in which smoking is either proscribed for religious reasons or does not otherwise form part of the cultural pattern.

Two of the four basic study elements required are at hand: data on the distribution of smoking habits in the United States population (collected as part of the Current Population Survey for February 1955), and data on lung cancer mortality (from publications of vital statistics offices). The major problems would be to secure the cooperation of the groups selected and to develop procedures to obtain the counterparts of these data for their memberships. To avoid artifacts which might be introduced by classification procedures, the primary test must be whether the overall lung cancer mortality in the group studied was markedly less than for an appropriate segment of the population of the United States and commensurate with differences in the smoking patterns. To this, other refinements may be added, such as observing whether mortality differences between the study and control populations disappear when specific comparisons are made by amount of tobacco smoked.

The limited number of countries which can provide reliable diagnostic data on causes of illness and death has discouraged similar studies of groups abroad which have unusual smoking patterns. However, special study situations may be encountered. One illustration is cited, without judgment as to its intrinsic merit. The director of the Hadassah medical organization recently reported the absence of a single case

of lung cancer among Yemenite Jews in Israel during the past 15 years, and he further observed that they did not smoke cigarettes but used a form of Oriental water pipe (27). Israel is a country with western standards of medical care and this lead may be worth pursuing. In these matters, the importance of reviewing the primary sources of population, morbidity, and mortality data should be stressed.

Other clues may lead indirectly to population groups with unusual smoking histories. For example, Steiner (6), on the basis of necropsy evidence in Los Angeles, has found a possible exception among Mexicans to the usual sex ratio for lung cancer; the proportion of Mexican women with lung cancer at autopsy approaches the proportion for Mexican men. This suggests the need for further studies among Mexicans to confirm the facts and to uncover possible reasons for the aberrant sex ratio for lung cancer. This might conceivably lead to the finding of a group of unusually heavy smokers among women, a useful contrast to the experience of abstainers.

### **Corroborative Details**

Additional details on the nature of the smoking-lung cancer relationship should be assembled from large-scale forward studies. These possibilities were obviously in the minds of those who planned the American Cancer Society and the National Cancer Institute-Veterans Administration studies. Both study groups consist mainly of men between the ages of 50 and 69, the ages of highest lung cancer incidence.

One approach is to expand the evidence on the nature of the association by detailed cross-classification. Epidemiologists have long accepted the principle that the etiological significance of an association is enhanced if it can be shown to persist within a variety of sub-universes. The National Cancer Institute-Veterans Administration cohort can be subdivided with respect to occupation and industry. By lengthening the observation period to several years, further tests can be applied in both studies, including checks on the consistency of regression relationships between lung cancer mortality and amounts of tobacco smoked for

several occupational groups and for urban and rural residents.

Additional tests can be pursued by relating age at death to "age started smoking" to see if any consistent pattern emerges.

### **Studies Among Women**

Unfortunately for study purposes, the spread of "age started smoking" is not too great among men, and it may be hard to assemble sizable cohorts for the more unusual combinations of year of birth and "age started smoking." Women would be more promising subjects, since women of all ages began smoking in large numbers during the 1930 decade, and duration of smoking by women is not so closely tied to chronological age. For this reason, more prospective and retrospective studies on smoking and lung cancer among women would be rewarding. In addition to the one series of studies on smoking among women reported by Doll and Hill (28), two retrospective studies are known to be under way. The relative rarity of lung cancer among women imposes severe study handicaps and has undoubtedly deterred other efforts.

Potential cohorts for followup would include employed women covered by group life insurance policies. To minimize turnover and loss to observation it would be desirable to restrict the cohort to employees with several years' service.

Studies of lung cancer among women should establish what part, if any, of the sex differential in lung cancer mortality (or incidence) disappears when comparisons are made specific for smoking class. The fragmentary Doll-Hill data suggest that a good part, but not all, of the sex differential may be accounted for in this manner.

### **Indirect Checks**

Retrospective and prospective studies may be viewed as efforts to secure etiologically meaningful data, which official vital statistics sources cannot provide, since they are limited to classification by standard demographic variables. There is another transitional bridge by which vital statistics data on lung cancer deaths can

be utilized. By taking information on smoking patterns in the general population (collected in Current Population Survey for February 1955) and applying to them the data on absolute and relative lung cancer risks by smoking class as reported in the preliminary results of the American Cancer Society study (29) and in several retrospective studies (30), the "expected" distribution of lung cancer deaths can be computed by sex, urban or rural residence, geographic region, and broad occupational groups, on the assumption that risks by smoking class in the groups studied hold also in the total population. Comparison of the observed and "expected" numbers of deaths would then show how much of the prevailing variation in lung cancer mortality can be accounted for by considering smoking histories. In this manner, some useful consistency checks on the smoking-lung cancer model would be provided.

Such consistency checks need not be confined to smoking histories. The Current Population Survey material illustrates an economically feasible means for remedying some deficiencies in standard population classifications. Although many investigators have expressed the need for procuring information on the population distribution of characteristics under study, they have often been deterred by the cost. Probability sampling methods for gathering such data can provide a powerful tool to the epidemiologist.

### Other Possible Factors

Turning from suspected environmental agents with properties which permit direct contact with lung tissue, several possible causes of lung cancer remain. There is the class of environmental agents which do not come in direct contact with lung tissue. Closely related would be possible tissue changes induced by virus and other infectious agents. Constitutional susceptibility might also be considered. If some persons have a predisposition to attacks on lung tissue by some morbid process, the rise in lung cancer might be due to the suppression of "competitive" respiratory causes, such as tuberculosis and pneumonia. Finally, there is the possibility of the association of smoking with other physical, psychological, and emo-

tional factors which may be engendered by the processes influencing persons to take up smoking.

In dealing with lung cancer, where prospects for tests of etiological relationships by trial of control measures are remote, other hypotheses, however unlikely, and the collection of evidence to support or discredit them should be encouraged. The pursuit of other lines of investigation will be useful. If results are positive, another effect of lung cancer will have been discovered; if negative, they will buttress the interpretations applied to effects already known.

Gilliam, in a general discussion of chronic disease epidemiology, alluded briefly to a variety of items investigated by him in a study of lung cancer patients and controls, using the retrospective, case-history method (31). These items ranged from color of eyes and use of dentures to histories of illnesses and use of general anesthetics. As he hastens to say, such individual findings cannot be used for any generalizations. However, it may be worth while to inquire systematically into other findings collected but never deemed worthy of report. Several of the other early retrospective studies were "shotgun" inquiries and collected information on a variety of suspected agents and exposures. Collectively, these results might prove useful for testing and discriminating between hypotheses and the planning of further studies.

Several studies exploring characteristics differentiating smokers and nonsmokers may be expected. The question of differences between the two groups arises because smokers select themselves; smoking is not a treatment which can be studied experimentally by randomized application to a population. There is a wide range of possibilities for retrospective studies on the physical, psychological, and emotional attributes of smokers and nonsmokers. The demonstration of an item as being associated with smoking history is essentially a screening device. The further test is whether the item, when applied to a population, produces differences in lung cancer risks equal in magnitude to those yielded by smoking history classifications (if smoking history is uncontrolled), or whether an effect is observed when smoking history is controlled by classification.

## Association With Other Illnesses

Some theories on the subsequent increased risk of lung cancer among persons with histories of respiratory illnesses such as influenza, pneumonia, bronchitis, and tuberculosis, based usually on clinical and pathological impressions, have been reviewed by Doll (32), who continues on to point out some observations inconsistent with these theories. No associations of lung cancer with the presence or absence of an antecedent illness have yet been established by observations on populations through the use of retrospective or prospective studies. Retrospective studies are handicapped in this field, because patients with lung cancer and other respiratory disorders apparently recall previous respiratory ailments more readily than do other persons. There are some possibilities for forward studies on cohorts known to have recovered from specific illnesses, free from the "recall" bias in the retrospective approach, which may be exploited. For example, records can be assembled of World War I veterans who had influenza and/or pneumonia in 1918. These veterans can be traced forward in time to determine their lung cancer mortality experience. (A study of British veterans (40) has been published recently.) From civilian life, one could draw on recovered pneumonia cases reported to health departments in the 1930 decade, when these agencies had active programs based on pneumococcus typing and distribution of serum.

If excess lung cancer mortality among such groups were demonstrated, this would not necessarily be a result of effects of antecedent illnesses. If constitutional predisposition of lung tissue were a factor, the rise in lung cancer mortality might be due to the suppression of tuberculosis and pneumonia as causes of death. If a genetic basis for constitutional predisposition to lung cancer were postulated, other tests could be devised. One approach would be to assemble lists of relatives of diagnosed cases of lung cancer for followup to determine lung cancer mortality. Lists of familial contacts could be assembled from records maintained in tuberculosis control programs. Investigations of this character might be undertaken more readily in some European countries, where pop-

ulation mobility is low and more comprehensive population record systems exist.

## Retrospective and Forward Studies

The preceding sections have emphasized the wide range of possibilities for the use of retrospective and forward study techniques. Retrospective, case-history studies use as their point of departure diagnosed cases of a disease and matched controls and compare antecedent events in their previous histories. Prospective, or forward, studies start with the assembly at a fixed point in time of defined cohorts classified with respect to certain attributes, trace them forward in time, and note events occurring subsequently.

Perhaps the major criticism of retrospective studies for lung cancer has been that diagnosed cases have generally been drawn from hospital populations. Positive association between two diseases, not present in the general population, may be produced when hospital admissions alone are studied, because persons with a combination of complaints are more likely to require hospital treatment (33, 34). Smoking is not an illness, and for lung cancer it is difficult to see how the smoking history could have any influence on hospital admission. Lung cancer is a serious disease normally requiring hospitalization, and roughly four-fifths of all diagnosed cases are hospitalized (35). The proportion is even higher when microscopically confirmed cases alone are considered. There would have to be extraordinary differences in smoking histories between hospitalized and nonhospitalized patients and controls to upset inferences drawn from hospitalized cases (36). So far, the results of forward population studies on excess lung cancer risks among smokers as compared to nonsmokers have agreed in general with those of the retrospective studies. This suggests that biases entering into the selection of hospitalized cases and controls studied retrospectively are probably not the source of the associations noted.

The fundamental assumption underlying retrospective studies and the estimation therefrom of differences in risks between population groups is that the diagnosed cases and controls each be representative of the universe chosen

for investigation. Although there are precautions which can be taken in devising a sampling plan, this representative property cannot be guaranteed merely from internal examination of a single set of data. One must be guided on this point by the comparison of results from several studies and judgment as to the possible biases operating in any setting.

Forward population studies have been questioned on the grounds that the cohorts have not been selected by probability sampling methods and that individual study results cannot be generalized to the total population. The expense involved in tracing cohorts drawn from the general population by probability sampling methods would be great and most investigators have been forced to look for populations followed routinely for other purposes, such as persons covered by employment or insurance benefits.

The criticisms of unrepresentative sampling would appear to disregard the experience available from actuarial sources. There are two common types of insurance: "ordinary" policies, which require applicants to pass a physical examination, and "industrial" policies, which undergo some underwriting selection but require no physical examination. Policyholders would scarcely meet the usual criteria for representative samples. The Metropolitan Life Insurance Co. has published extensive data on the mortality experience of their industrial policyholders and finds rather close agreement with the mortality experience of the general population, after appropriate adjustments for age, sex, and race composition (37). Data drawn from actuarial experience and reported in such sources as *Length of Life* (38) and *The Statistical Bulletin*, a monthly publication of the Metropolitan Life Insurance Co., indicate that the relative patterns of mortality with respect to cause, age, sex, race, and geographical region in insured populations have their counterparts in general mortality experience despite some differences in magnitude of rates. The cohorts assembled for smoking and lung cancer investigations do not appear to have been subjected to more rigorous selection than that encountered by industrial policyholders, nor is there reason to believe that the selection effects which did exist discriminated between smokers and nonsmokers. Even when stronger selection

effects on mortality experience exist, as in the case of ordinary policyholders, it is well known that the selection effects of physical examinations on mortality experience wear off quickly: very conservatively, in 10 years or less (39), usually in about 5 years. If there is any question about the prospective study results on the association of smoking and lung cancer being affected by selection, the conservative course would be to discount the first few years' experience and to require that the early results be confirmed by later experience after selection effects have worn off.

The collation of experience from several studies is also a safeguard against error in generalizing from forward studies on lung cancer. Data from prospective studies may be subclassified by other population characteristics and further checked for internal consistency. With these precautions, the dangers of drawing inferences from forward and retrospective studies inapplicable to the general population seem rather remote.

### Summary

The size of the lung cancer problem, as indicated by the number of lives at stake and the economic implications of any potential control measures which might later be advanced, should not blind investigators to the many possibilities for studies similar to those on other chronic diseases which have yielded some of their secrets to the epidemiological approach. Diseases showing pronounced variations in risk among population subgroups are the more amenable to epidemiological study; and lung cancer falls into this category. Studies on human populations should continue to play an important role in delineating possible etiological relationships for lung cancer, the mechanisms for which could then be elaborated by animal experimentation.

Progress must come by the cross-checking of the several results of epidemiological studies, animal experimentation, and other laboratory findings. The issues will probably be settled by an evolutionary process, as was the fluoride-dental caries relationship. Gradually, the meaning of certain associations will become accepted. Dissent will die off and the debate will shift to the many other points in any

epidemiological models still requiring elaboration.

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## Ninth Annual Seminar on Seafood Sanitation

The ninth annual Seminar on Seafood Sanitation, sponsored by the Virginia and Maryland State Health Departments, was held in Solomons, Md., September 27-29, 1955. More than 50 persons attended the 5 sessions, which included an inspection of an oyster-packing house and a visit by boat to a soft-clam harvesting area on the Patuxent River.

The first Seminar on Seafood Sanitation was held in 1946 because seafood sanitation specialists found that their work required broad up-to-date technical knowledge. In addition to the common food plant sanitation problems, they were concerned with the construction and operation of municipal and private sewage disposal works; they had to make bacteriological, hydrographic, and sanitary surveys of shellfish-growing areas; and they were obliged to apply the results of these studies to decisions on the suitability of an area for shellfish culture. The seminar has provided a forum where bacteriologists, sanitarians, and sanitary engineers working with seafood sanitation in the Chesapeake Bay area can exchange information on such problems of mutual interest.

Many seafood sanitation problems encountered by county, State, and Federal personnel were discussed at the 3-day meeting. These included sanitary surveys of shellfish-growing areas, general food plant sanitation, sanitation of oyster-shucking plants, sanitation problems in the crabmeat industry, sanitary

problems in the new Chesapeake Bay soft-clam industry, preservation of food by radioactive sterilization, and a discussion of the relative merits of State certification of processors of breaded seafood.

Included in the agencies represented in the discussions were State health departments of Maryland, Virginia, South Carolina, Georgia, and the District of Columbia; New York State Department of Conservation; Maryland county health departments which have seafood sanitation programs; the Food and Drug Administration and the Public Health Service; and the Fish and Wildlife Service. The seafood industry was represented by officials of the National Fisheries Institute, the Oyster Institute of North America, and the Oyster Growers and Dealers Association of North America, Inc.

William Ballard, president of the Oyster Growers and Dealers Association of North America, Inc., and operator of one of the world's largest oyster-shucking and packing plants, told of his industry's dependence on sanitation and expressed the opinion that the future of the seafood industry rested with the accomplishments of the fisheries research scientists and with the seafood sanitation specialists.

The participants recommended that the health departments of Maryland and Virginia sponsor another seafood sanitation seminar in 1956.

Federal and State health authorities and representatives of State medical societies met during March and April 1955 to consider the health problems involved in protecting the civilian population from the effects of modern weapons of war. The conferences, which were held in each of the nine regions of the Department of Health, Education, and Welfare, were conducted by the Public Health Service in cooperation with the Association of State and Territorial Health Officers, the Federal Civil Defense Administration, and the American Medical Association. Emphasizing that it expects to discharge its civil defense responsibilities to the very best of its ability, the Public Health

Service reported its existing plans and activities and presented current facts related to defense against biological, chemical, and radiological warfare. An important objective of the conferences was to secure advice from the States as to how the Service can best help them in providing the health services needed in civil defense. One of the conference papers is given here in full, and five others are given in brief. A seventh paper, a discussion of biological warfare defense by Keith H. Lewis of the Robert A. Taft Sanitary Engineering Center, was omitted from this summary. A glossary on radiation terms appears on p. 192.

## Biological-Medical Considerations in Atomic Defense

By EDWIN G. WILLIAMS, M.D., and SAMUEL C. INGRAHAM II, M.D., M.P.H.

THIS discussion of defense against atomic attack centers around atomic radiation, as distinct from the blast and heat effects of a nuclear reaction. Right at the start, we need to pause for a moment to gather some perspective on the problem of radiation from a nuclear weapon. As stated in a recent Federal Civil Defense Administration publication (1):

"A surprise daylight attack with a nominal

bomb [20 kilotons] exploded at 2,000 feet over an 'average' metropolitan area would produce a total of about 120,000 casualties—killed and injured.

"Of this total, 40,000 (33⅓ percent) would either be killed outright or would die the first day. . . . Thus, probably 80,000 casualties (66⅔ percent) would survive the first 24 hours. Of these 80,000 it is estimated that:

48,000 (60 percent) would be suffering from burns;  
40,000 (50 percent) would be suffering from mechanical injuries;  
16,000 (20 percent) would be suffering chiefly from radiation injuries."

NOTE: The total exceeds 100 percent because many of the casualties would be suffering from two or more types of injuries.

Thus, we see that radiation injuries are expected to constitute only a small percentage of

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the total injuries caused by an atomic bomb attack. But treatment of burns and traumatic injuries, from which 80 plus percent of the casualties would be suffering, are a well-accepted part of orthodox medical practice; so, albeit somewhat arbitrarily, we are disregarding the vast problems of these injuries. Radiation injuries, on the other hand, are novel to many physicians, and for most nonmedical people they carry an aura of absolute mystery. For this reason alone, we shall limit this discussion almost exclusively to the radiation aspects of nuclear weapons.

The increasing size of atomic explosions and the development of hydrogen-fusion bombs with the power of millions of tons of TNT have recently increased probability of radiation injury from nuclear weapons. The following information, based on an official release of Chairman Louis L. Strauss, Atomic Energy Commission, was published recently (2):

"Fallout from [a] hypothetical H-bomb dropped on Washington, D. C., . . . could cause deaths as far as New York City, 220 miles away. In [a] 10-mile-wide circle everything would be wrecked by blast. Heavy chunks of radioactive debris would rain down. But lighter debris and dust would be blown 80,000 feet high. Assuming . . . that winds are northward [which the prevailing winds are], the dust cloud would drop its radioactive cargo in [a] cigar-shaped zone about 220 miles long and over 20 miles wide. Radiation, decreasing with distance from the blast, would be nearly 100 percent lethal for unprotected persons out to 140 miles from ground zero [these days it really is 'arca zero'], diminishing to 50 percent lethal between 140 and 160 miles away, and dropping from 10 percent lethal to safe between 160 and 220 miles away."

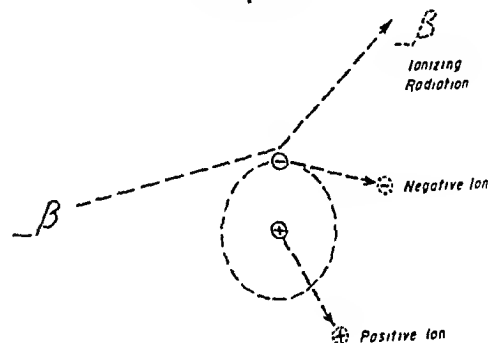
Contrast this radiation effect to that of an atomic bomb, where the expected number of persons disabled by radiation is relatively small. The fallout from hydrogen bombs could affect many millions of people. In certain population areas, several million could be exposed to a lethal dose.

Now, with another reminder that radiation comprises only one phase of the medical problem in atomic warfare, we shall consider pertinent biomedical effects of radiation.

## How Radiation Affects Tissue

Atomic radiations, whether they arise from nuclear weapons, from radioisotopes or radium, or from radiation-producing machines, share one distinctive property: During the process of absorption in the body, they all interact with tissue by splitting atoms and molecules into pairs of electrically charged fragments called ions (fig. 1).

Figure 1. Ionization of a hydrogen atom by a beta particle.



The remarkable effectiveness of atomic radiations in causing biological injury stems from their property of acting directly on the individual atoms and molecules composing tissue. By their ionizing effect, radiations may eject electrons from atoms, break up chemical compounds, displace atoms in organized molecules, generate toxic substances and, in general, cause important changes in the submicroscopic structure of body cells.

The potency of radiations may perhaps be appreciated more concretely if one compares, for example, the power of alpha particles (to ionize and injure molecules) with the power of shotgun pellets (to injure people). Relative to their respective targets, alpha particles are 28 times heavier than No. 5 shot (fig. 2). And the speed of 1-Mev. alpha particles exceeds the muzzle velocity of No. 5 shot from a 12-gauge shotgun by well over a quarter of a million times. A shotgun fired at a man can injure or kill him. Alpha particles striking tissue can ionize its molecules and injure or kill its cells. A single shotgun pellet, if it strikes a vital spot, can be fatal. A single alpha particle (or for that matter, any other single radiation), if it

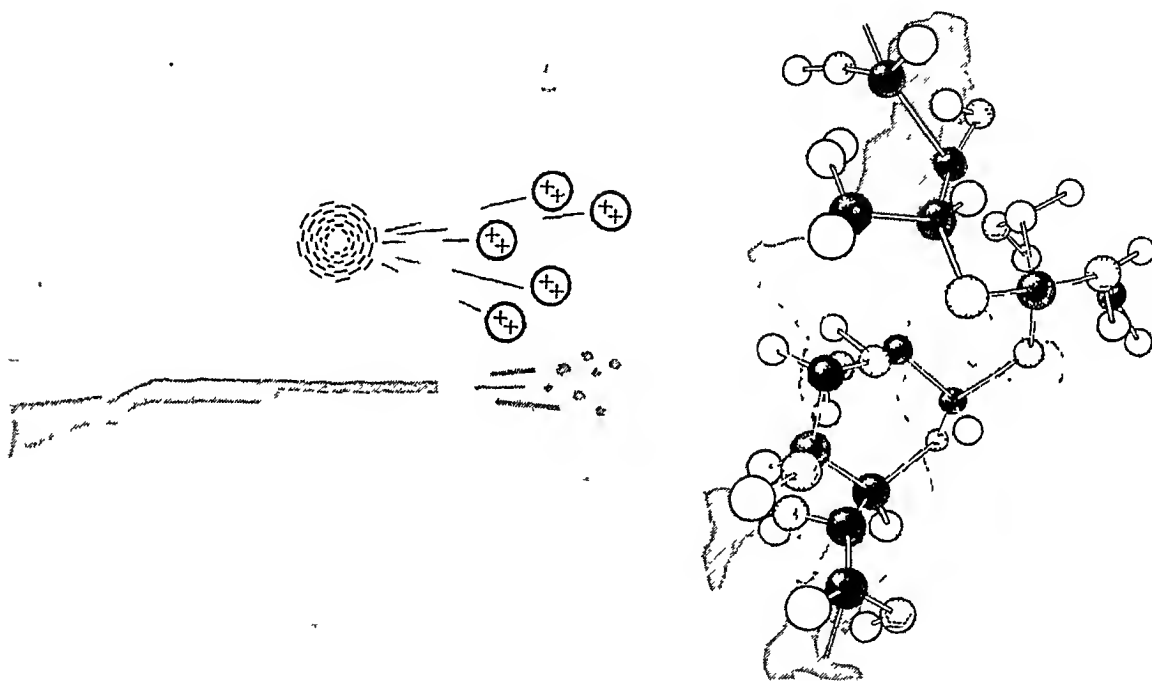
ionizes a critical molecule, can kill a cell or possibly start a cancer.

The specific injury produced by radiation in any given circumstance probably depends on many variable factors, such as the density of ionization, the kind of tissue irradiated, and the kind or location of the molecules affected. Observed injuries include the mutation of genes, inactivation of enzymes, inhibition of cell division, and fatal disturbance of tissue functions.

So far as we know, there are four possible re-

mediate external warning that a sublethal or even a minimum lethal dose of radiation has been received. Some changes appear early. Others may be seen only after prolonged periods of latency. Evidence of injury from minimal doses of radiation may not show up for months or even years.

The recognizable changes produced in cells by radiation are of many sorts. They include changes in permeability of the cell membrane, changes in the staining characteristics of cells,



**Figure 2. Comparison of the power of alpha particles to injure a molecule with the power of shotgun pellets to injure a man.**

sults of exposing a living cell to radiation (fig. 3). The cell may be killed. It may be crippled, transiently or permanently. Or it may merely have nonessential molecules ionized and, therefore, actually not be harmed at all by the radiation. Symptoms of radiation injury (skin erythema, radiation sickness, decreased fertility) appear in an individual only after a sufficient number of cells have been injured or killed. Unless the exposure has been sufficient to cause skin erythema, there may be no im-

changes in viscosity of the protoplasm, changes in chromosomes, swelling of cellular components, production of abnormal cell divisions, distortion of cell structure, and many more obscure but measurable changes.

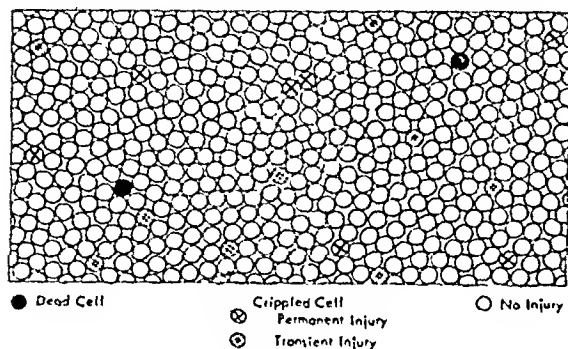
#### Variations in Radiosensitivity

Each of the human body's many different tissues responds differently to radiation exposure. The responses, in general, are a summa-

tion of the responses of the various cells and cell types composing the specific tissue.

Rapidly growing or metabolizing tissues are usually more sensitive to radiation than are quiescent tissues. Lymphocytic tissues (lymph nodes, tonsils) are more easily affected than are muscle or nerve tissues. Tissue cells in an organ are more easily injured by radiation than tissue cells grown in a culture.

Figure 3. Diagram of irradiated tissue.



Tissues so differ in reaction to radiation absorption that it is possible to classify them, in a loose fashion, according to the doses of radiation they will successfully withstand. Any such classification is empirical and, since it disregards important variables other than dosage, is far from exact. Various authors place some of the tissues in a slightly different order of radiosensitivity. However, the principle of specific tissue sensitivity is generally accepted. The following list is based on the available data and represents the approximate response of tissues exposed to divided doses of roentgen rays generated at 200 kilovolts (3):

**Highly radiosensitive** (cells seriously injured or killed by doses of 600 roentgens or less): lymphocytes; bone marrow cells; sexual cells (testicle and ovary).

**Moderately radiosensitive** (cells seriously injured or killed by doses of 600 to 3,000 roentgens): salivary glands; epithelium of skin; endothelium lining blood vessels; bone (growing); epithelium of stomach and intestine; connective tissue; elastic tissue.

**Radioreistant** (cells show little damage unless dose exceeds 3,000 roentgens): kidney; liver; thyroid, pancreas, pituitary, adrenal, and parathyroid glands; bone (mature); cartilage; muscle; brain and other nervous tissue.

Quite recently, we have been told that the organ systems most fundamentally affected are

the central nervous system, the blood forming organs, and the gastrointestinal tract. Nerve tissues, for example, do not recover from injury as do many other tissues.

The recovery of tissues showing any specific radiation effect is dependent upon the ability of the individual cells composing it to recover and reproduce. This in turn depends upon the dose of radiation absorbed and the types of cells present. The blood forming organs, the skin, the membranes lining body cavities, and the secreting glands may regenerate completely and resume their normal functions. Muscle, brain, and portions of the kidney and eye cannot regenerate; repair of them results only in scar formation. Even those tissues that can regenerate may fail to respond after repeated ionization and so cause conditions such as nonhealing ulcers or aplastic anemia. Also, repeated regeneration may produce cancerous conditions: epitheliomata, fibrosarcomata, or leukemia. These changes have all been observed in animals following radiation exposures at levels corresponding to doses only slightly above the accepted safe limits for man. There are no constant clinical symptoms which can be relied upon to warn of latent radiation injury before the late changes become manifest.

Not only is there marked variation in radiation sensitivity of different kinds of cells and tissues within an individual; there is also some variation in the radiosensitivity of individuals of the same species and even more variation among different species.

If killing power is selected to measure the effect of radiation exposure and if mice are selected as the test animals, it may be demonstrated that as the dose of X-rays given over the entire body increases from 200 to 1,000 roentgens the acute mortality rate from irradiation in successive groups of exposed mice will increase from 10 to 100 percent. In addition, the onset of lethal effect will show a latent period which shortens from 8 to 2 days or less as the radiation dose is increased.

If the dose of radiation that within 30 days will kill 50 percent of the individuals exposed (median lethal dose or  $LD_{50}$ ) is selected as a measure of the biological effect of radiation, the variation in radiosensitivity from animal

species to animal species becomes apparent. The approximate LD<sub>50</sub> X-ray doses for several of the more common experimental animals (based on actual experiments) and the estimated median lethal dose for man (based on animal experiments, reactions of X-ray therapy patients, and data collected in Japan) are as follows:

<i>Animal</i>	<i>Dose (roentgens)</i>
Guinea pig-----	175-250
Dog-----	325
Goat-----	350
Man-----	400-450
Mouse-----	530
Rabbit-----	800
Rat-----	825-900
Weevils-----	1,000-2,000
Molds-----	2,000
Bacteria (nonspore forming)-----	1,500-2,000
Bacteria (spore forming)-----	20,000-50,000
Viruses-----	50,000-1,000,000

The potency of radiation to injure tissue is possibly better appreciated when one realizes that 1 roentgen produces about 1,000 ionizations among the atoms in each body cell exposed. Since the adult human body is composed of about 140 trillion cells, this means that exposure of the whole body to the maximum permissible dose for radiation workers (0.3 roentgen per week) will result in about 7 quadrillion ionizations per working day in the body. The human LD<sub>50</sub> dose (450 roentgens) will ionize about 1 atom in every 100 million in the body, or about 450,000 atoms per cell, on the average.

### Effect on Life Expectancy and Fertility

Experimental observations of many different species indicate that radiations induce an aging and debilitating effect. Each roentgen of exposure probably shortens life expectancy of an animal by about one ten-thousandth. This implies that an exposure rate of 0.4 milliroentgen equivalent physical per day (about what man receives from cosmic and other naturally occurring radiation) may shorten the expected life span of a human being by about 4 weeks, if the effect of radiation in man is like that in animals; or 50 roentgens of exposure may shorten the expected human life span by as much as 18 weeks. Also, radiation exposure induces an increased susceptibility to infection.

There is a wide range of specific radiation effects from a wide range of doses. In general, the larger the dose, the more prompt and dramatic are its biological effects; the smaller the dose, the more delayed and more insidious are its biological effects.

In every discussion of the effects of ionizing radiations one of the first questions put to the physician is, "Will it make me sterile?" In response, the physician usually finds it necessary to distinguish between potency and fertility. No direct effects on potency have been reported. Fertility has been affected.

Permanent sterilization of the human female requires 400 to 600 roentgens delivered to the ovary. Sterilization of the human male can be produced by 800 to 1,000 roentgens delivered to the testes. Either of these doses given as whole-body radiation would probably be lethal to the individual, and so danger of causing permanent sterilization by single whole-body exposures becomes a theoretical rather than a practical question. Reduced fertility and temporary sterility have been induced in human beings by single exposures of 200 to 300 roentgens to the gonads and in animals by repeated exposures of as little as 1 roentgen per day for a number of weeks.

A survey a few years ago found that the average number of children born to a group of radiologists was 1.7, whereas the average number of children born to a comparable group of physicians not engaged in roentgenology was 3 (4). Inasmuch as the major difference between the two groups of physicians, so far as could be determined, was the practice of roentgenology, these data may indicate a reduction in human fertility from repeated exposure to relatively small doses of X-rays.

### Effect on Genes

Genetic, or hereditary, changes may arise from doses of radiation much smaller than those needed to affect fertility. Many genetic experts believe that *any* amount of ionizing radiations may produce hereditary changes cumulative throughout the lifetime of the germ plasma line that can and will appear in future generations. There is, however, no current evidence that radiation workers (X-ray technicians, radiolo-

gists, atomic workers) who have not abused the maximum permissible dose limits have produced offspring differing from those of the general populace.

Specifically, from the human genetic studies being made of the completed pregnancies among the surviving victims of the atom bombings at Hiroshima and Nagasaki, at least one positive finding has been reported. The expected normal male-female ratio has been upset among offspring of women exposed within 2,000 meters of ground zero (the point immediately beneath the exploding bomb) by a statistically significant decrease in male births (5).

Ionizing radiation can alter the genes in the body (somatic) cells and in the reproductive (sexual) cells and so cause them to grow or reproduce abnormally. If a gene change occurs in a sexual cell, a mutation will occur in later generations provided that the cell is used in reproduction. If a gene change occurs in a cell of growing or regenerating somatic tissue like skin, liver, bone, or bone marrow, it may cause cancerous or other harmful changes in the exposed individual.

Both somatic and sexual cell mutations produced by radiation have been observed in human beings. Statistically significant increases in numbers of mutations have occurred in offspring of parents with a history of exposure to either acute or chronic radiation. An increased incidence of cancers has been recorded in people exposed to amounts of radiation similar to those that produce genetic mutations or cancers in animals. Peller and Pick (6) in 1952 reported that among physicians in the United States, there were 8 to 9 times as many fatal cases of leukemia among radiologist physicians as among nonradiologist physicians.

The probability that a cell may be ionized increases in proportion to the number of cells exposed to radiation. As there are many more somatic cells than sexual cells in the human body, somatic cells are the more likely to be changed genetically from a given whole-body exposure. Thus, from the point of view of radiation-produced gene changes and their effects on human beings, one probably should avoid needless radiation exposure at least as much for his own health protection as for the genetic protection of his progeny.

## A Calculated Risk

In the civil defense program, we must think of radiation exposure in terms of calculated risk. Exposures ought to be held as low as possible, but doses permitted must allow for such exposures as are unavoidable in accomplishment of essential missions.

No predetermined dosage schedule can be set, in advance of an emergency situation, that will evaluate the relative importance of a given civil defense mission. This evaluation is a command decision to be made by the responsible civil defense official on the spot, at the time. However, one guide in such decisions will be the following data on radiation effects, which were compiled for the FCDA:

<i>Dose (roentgens)</i>	<i>Observed effects</i>
0-25-----	No obvious injury. An average person receives 10-20 roentgens over a lifetime from naturally radioactive sources.
25-50-----	Least clinically detectable exposure—possible blood changes but no serious injury. 50 roentgens in 1 day is safe if not repeated too soon.
50-100-----	Blood cell changes, some injury, no serious disability. 100 roentgens causes sickness to approximately 10 percent of the persons receiving this dose.
100-200-----	Injury, possible disability, probably no deaths. 150 roentgens causes sickness to approximately 25 percent.
200-400-----	Injury and disability certain, death possible. 200 roentgens causes sickness to approximately 50 percent, death to approximately 2 percent. 300 roentgens causes death to approximately 20 percent.
400-450-----	Fatal to 50 percent of persons exposed; death occurs within 2 to 12 weeks.
600 or more-----	Lethal dose causing death to nearly all persons exposed within 2 weeks.

As with other biomedical values, there is nothing magical about the roentgen values given here. The several effects listed merge gradually one into the other as the dosage increases; so, if another table shows slightly varying values, one should not consider this or that table correct and the other one wrong. Rather, the differences will probably be an expression of the normal range of values seen in any biomedical situation.

Among atomic bomb casualties there will be many with multiple injuries. Dual or triple modes of injury may be the rule rather than the exception. Victims may have burns, traumatic injuries, and radiation injuries in any combination. Prognosis in each case will depend on the types and extent of the injuries. Those with radiation injuries in addition to more orthodox injuries will tend to have a graver prognosis than those not having radiation injuries. The reason for this is that one of the important effects of whole-body exposure to atomic radiation is to impair the effectiveness of body mechanisms responsible for resistance to infection and disease and for healing and repair of injured tissues.

Radiation exposure incurred from the atomic flash is, of course, practically instantaneous. That from radioactive fallout, because of the rapid decay of this material, should be thought of as being suffered within a quite short time span: More than 80 percent of the radiation dose from atomic debris will be delivered within 10 hours of the explosion time. The radiologists tell us that radiation exposures delivered over a time span of minutes or hours may be thought of as having effects identical to an instantaneous exposure of the same roentgen value. On the other hand, exposures incurred over a period of days or months have less total biomedical effect on the body as a whole than would the same cumulative roentgen dose if it were delivered over a period of only hours or minutes.

### Radiation Sickness

Radiation sickness is the term used to describe the illness produced by overexposure to atomic radiations. The accumulated evidence indicates that radiation sickness represents a symptom complex which may be divided into the following five groups:

1. *General symptoms*: Headache, vertigo, debility, abnormal sensations of taste or smell.
2. *Gastrointestinal symptoms*: Anorexia, nausea, vomiting, diarrhea.
3. *Cardiovascular symptoms*: Tachycardia, arrhythmia, fall of blood pressure, shortness of breath.
4. *Hematological symptoms*: Leukopenia,

thrombocytopenia, increased sedimentation rate, decreased resistance to infection.

5. *Psychic symptoms*: Increased irritability, insomnia, fear.

Not all the symptoms of radiation sickness occur in each patient. Also, the same patient may react differently at different times to similar radiation doses. In general, the greater the radiation exposure, the quicker and more dramatic is the appearance of radiation sickness. For those interested in more details of human and animal responses to radiation exposure, it is suggested that they refer to the voluminous medical and other scientific literature on this subject.

### Therapeutic Measures

There are no known specific agents for the treatment of radiation injury. There are no practical prophylactic drugs to temper or avert radiation injury consequent to adequate exposure to radiation. Medical research is continuing in an effort to discover and develop better means of diagnosis, prophylaxis, and treatment for the victims of all types of radiological hazards, including atomic attack.

The recommended therapeutic measures for radiation sickness and its sequelae are almost exclusively symptomatic or supportive in nature. They include:

1. Bed rest plus sedatives to reduce stress demands on the body economy.
2. Therapy to improve nutrition and maintain fluid and mineral balance.
3. Measures to reduce or prevent infection: Antibiotics; aseptic techniques in nursing and medical care with emphasis on mouth and skin hygiene; leucocytic cream.
4. Antishock drugs.
5. Antihistamines (on the theory that shock is precipitated or made worse by histamine produced by the radiation-injured tissues).
6. Antigastric secretants and antinauseants.
7. Antihemorrhagic drugs.
8. Miscellaneous drugs, such as glucose, glucose-saline injections, cholesterol, liver preparations, numerous vitamins, alcohol, insulin, corpus luteum hormone, Congo red desoxycorticosterone acetate (DCA), and ACTH.
9. Blood transfusions.

The opinions about the therapeutic values of these proposed measures are as varied as the number of substances listed.

Attempts at prophylaxis or prevention of radiation injury by pretreatment has been tried in animals with varying degrees of apparent success. Desoxycorticosterone acetate (DCA) has had some favorable effect in delaying radiation death as have cysteine, glutathione, and rutin. Subcutaneous or intermuscular injection of heterologous bone marrow appeared to have success as a radiation protectant for mice. The latest, most hopeful drug being tried is beta-mercaptoethylamine.

Probably the best summarization of present-day treatment measures for radiation sickness is contained in the final paragraph of the Report on the Medical Studies of the Effect of the Atomic Bomb by Dr. Masao Tsuzuki, professor at Tokyo Imperial University and chairman of the medical section of the Japanese National Research Council. Even though this document is now more than 6 years old, Dr. Tsuzuki's statement is still timely:

"The most important measures for the treatment of the radiation injuries is careful protection. All patients are affected more or less by the radioactivity; these must recover by their own vital power. In the cases in which the vital organs are damaged beyond their ability to recover, medical care at the present time cannot help. We may have some hope of recovery as long as any reserve power is remaining because the radiation exposure has occurred only once. We must, therefore, avoid such treatment as whipping a tired horse hastily. In other words, we should not be overconfident in the ability of our medical care. Our aim shall always be a promotion of the natural healing powers."

### Public Reaction

Quite as serious as the physical problem of radiation control is the problem of the public's psychological reaction to the use of radiation.

Misunderstanding of radiation coupled with fear of the unknown are usually enough to make a public wary of anything connected with atomic radiations. An injudicious warning about radiation may needlessly increase the difficulty of civil defense activities in the presence of atomic attack. On the other hand, it may be an even worse mistake to pay no heed to the hazards. Public health and civil defense workers can meet this issue by viewing radiation in proper perspective so as to establish and maintain measures for protection without doing psychological damage by their attitudes and statements. Once exposure has occurred, little can be done about the injury. It will not improve the situation to alarm or depress those who have been injured.

Radiation constitutes only a portion of the problems created by nuclear weapons. The major companion problems will be care for burns and traumatic injuries plus an enormous task of sanitation and hygiene for the homeless and dispossessed.

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# Radiological Defense



Radiological defense is a part of the integrated defense system of this country. It requires the knowledges and skills of specially trained technicians. However, many simple precautions of a nontechnical nature can be utilized to protect the public.

The detonation of a nuclear weapon is accompanied by the physical phenomena of light, heat, and blast and also by instantaneous nuclear radiations. The magnitude of each of these phenomena is proportional to the energy released in the detonation. Since we cannot see, hear, feel, taste, or smell ionizing radiation and radioactivity, they must be detected and their magnitude measured by sensitive instruments.

A great deal of what has been written about the effects of nuclear weapons is summarized in the accompanying chart. Incident thermal radiation on exposed skin will cause a first degree burn if the intensity is 2-3 calories per square centimeter, a second degree burn if the intensity is 3-7 calories per square centimeter, and a third degree burn if the intensity is 8-10 calories per square centimeter. An overpressure of more than 35 p.s.i. is required to do bodily harm to a person by blast alone. An overpressure of 19 p.s.i. will damage buildings irreparably; 19-6.6 p.s.i. will cause heavy damage; and 6.6-3 p.s.i. will cause moderate damage. Nuclear radiations released at the time of the explosion do not present a serious hazard beyond the effective range of heat and light. A longer-term hazard is created by the byproducts of the reaction: radioisotopes which fall out of the clouds.

## Fallout and Monitoring

As the cloud raised by a nuclear blast carries radioactive dust and debris aloft, this matter is swept out by shearing winds. The constituents

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of the cloud from a large thermonuclear weapon are as radioactive as millions of tons of radium. Fallout contains many species, or kinds, of radioactive materials, each of which decays at its own specific rate. Decay means that the atoms change to other elements; in the process radiations are released. The apparent radiation released by the fallout during the decay process is actually the sum of the radiations released by each individual radioisotope present. Both the decay rate and the intensity of radiation released in the decay process are indicated by the half-life of the material. The half-life is the time required for one-half of the atoms of a given material to decay. The shorter the half-life, the faster the decay and the greater the intensity of radiation produced by the decay process.

To monitor, or measure, the extent and magnitude of radioactive fallout, trained personnel use radiation detection instruments. Monitoring by plane is recommended in the early stages; ground monitoring should follow. The area contaminated by a fallout may be larger than 10,000 square miles.

## Estimating the Hazard

The half-lives of the radioactive materials in the atomic cloud range from a few seconds and minutes to thousands of years. The fallout will contain many radioactive species, some of which can be an internal hazard if admitted to the body, and all of which can constitute an external hazard when outside but in the vicinity of the body.

Estimates of the amount of radiation which a person might receive while in a fallout area are based on an empirical relationship between the initial intensity of the radiation from all the fallout materials, the time elapsed between the detonation and the start of exposure, and the length of time in the area.

As soon as the aerial monitoring crew can furnish a reading of average radiation intensity for an area or as soon as the ground monitor can give an average radiation intensity for a street, block, or even a room which has been contaminated with fallout, it is possible to calculate the intensity of radiation in that locality at any future time, providing, of course, that no decon-



tamination procedures are used and no additional contamination occurs. Tables, curves, and slide rules are available from which solutions to the problem can be read directly.

If the intensity of radiation remains relatively stable, as it does in the vicinity of long half-life radioactive materials, such as radium, uranium, or plutonium, the total dose of radiation can be determined simply by measuring the radiation intensity with an appropriate instrument and multiplying the result by the exposure time. When the intensity is on a sharply declining scale, as it is in a fallout area, probable exposure can be estimated by means of calculus. Tables, curves, and slide rules are also available for obtaining solutions to this problem directly.

### Decontamination

Radiological decontamination is still an unrefined science. Wise counsel is to avoid contamination if possible.

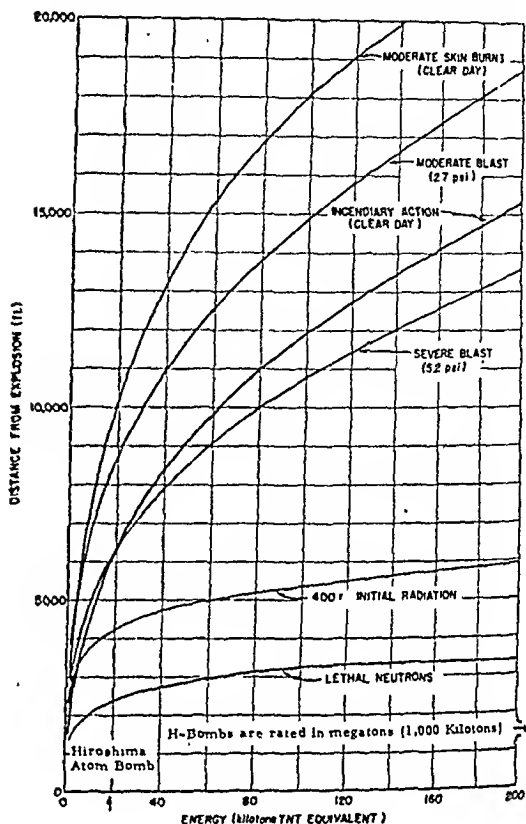
There is no practical way to destroy radioactivity. Since radioactive decay is entirely unaffected by physical or chemical reactions, decontaminating solutions such as those used in neutralizing mustard gas contamination are of little value against radioactive materials. The objective of radiological decontamination is to free an area from persistent radioactive agents. This necessitates removal and segregation of microscopic quantities of induced radioactive isotopes, fission products, and unfissioned parts of the bomb fuel.

Currently accepted principles of decontamination suggest the following procedures:

1. Immediate reduction to a minimum of that contamination of personnel and vital installations which cannot be or has not been avoided, by means of (a) complete bathing, monitoring, reclothing, administering of medical treatment when required, and evacuation of affected personnel; (b) washing and scrubbing down exposed surfaces to free them of loose contaminating particles; (c) temporarily covering short-range emitters (alpha or beta) with a coating, such as paint, to provide a partial shield against the emissions and prevent the spread of contaminants.

2. Subsequent thorough decontamination of

Distances from explosion at which various effects are produced as function of bomb energy.



areas important enough and of low enough radiation intensity to warrant such action, which may include (a) repeated scrubdowns; (b) removal and collection of closely adhering particles by using such chemicals as citric or hydrochloric acid, which make the particles more soluble; (c) removal and segregation of the surface to which the particles cling by using paint-removing solutions, scraping, or possibly wet sandblasting (if the surface material can be gathered for segregation).

3. Prevention of the spread of contamination, which may be accomplished by (a) preventing access to particularly "hot" areas; (b) using great care in disposing of grossly contaminated objects and the water and materials used in removing contaminating particles; (c) carrying out a carefully prescribed ventilation doctrine in air-conditioned shelters; (d) improvising a change station or decontamination center for the thorough decontamination of personnel and

their clothing and equipment (clothing may have to be buried).

The value of the operations mentioned in "1" and "2" should always be weighed against the possibility of temporary or permanent abandonment of the area or installation or the possibility of prescribing maximum periods of working time therein.

Salvaging Food and Water

Food in the damaged area may contain some induced radioactivity, but it is unlikely to be present in hazardous amounts. The largest source of contamination is fallout. Radioactive dusts may be deposited on foods or in water.

With respect to food or water that may be seriously contaminated, remember that radiation is less of a hazard when the source is outside the body than when it is within the body. Decontamination or shielding of the skin is far easier than decontamination of the lungs, liver, or bones.

To prevent accidental ingestion of radioactive materials, isolate all unpackaged foods that were located where the dust from a ground burst or mist from an underwater burst might have settled on them. Before opening canned or bottled foods, wash the outside of the container thoroughly. Also scrub all cooking utensils and tableware exposed to radioactive dust or mist. Foods and utensils in tightly closed drawers or cupboards will not be contaminated by fallout.

Water inside household pipes at the time of the explosion will probably not be seriously contaminated. If pressure is available, a little water can be drawn off immediately after the burst and placed in clean containers with covers. This water will be safe for consumption. Although the chances that the city water supply will be radioactive are pretty slim, be cautious about using tapwater for drinking thereafter. If possible, wait until official word is received that the water is safe.

General Information

All radiation is damaging and should be avoided whenever possible. In time of disaster, standards of permissible radiation tolerances

will have to be changed from peacetime to emergency levels. The amount of exposure to radiation will have to be weighed against the necessities; that is, it will be a calculated risk. If protective practices are observed, however, the chances of survival will be increased.

Alpha, beta, and gamma radiation will not cause foods, water, or the person to become radioactive. Neutron flux may induce some radioactivity, but everything within the neutron range will probably be damaged beyond recovery by blast and heat. Radioactivity in foods, water, or the body is the consequence of deposits of radioactive elements produced by nuclear reaction.

Because radioactivity cannot be liquidated, the handling of people or objects contaminated with radioactive materials is somewhat different from the handling of people or objects contaminated with any other type of dust. If a person handles people or objects contaminated with radioactive materials, he himself will not become radioactive, but some of the radioactive dust may attach itself to his clothing or body. Decontamination usually takes the form of scrubbing with soap and water. However, since you can't destroy radioactive materials, the wash water must be so disposed of as to guard against entry of the materials into the water supply.

In regard to shelter and shielding from radiation resulting from radioactivity in the fallout area, as long as we can prevent internal contamination, we need consider only gamma radiation. Assuming that the shelter is beyond the range of the instantaneous gamma radiation produced by a 15-megaton weapon, the following tabulations, prepared by Dr. R. E. Lapp, show the extent of the fallout areas that may be expected from this weapon, the average intensities of radiation in these areas, and the corresponding attenuation of radiation that may be expected from shielding material:

<i>Time after burst (hours)</i>	<i>Fallout area (square miles)</i>	<i>Average intensity of gamma radiation (roentgens/hour)</i>
1	250	2,500
3	1,200	200
6	4,000	30

<i>Reduction factor</i>	<i>Concrete (inches)</i>	<i>Packed soil(inches)</i>
10	6	11
50	11	18
100	13	21
1,000	19	30

It has been reported that a dose of whole-body radiation of 600-700 roentgens received in a short period of time would be fatal to all recipients. An unprotected person in the 250-square-mile area 1 hour after the atomic explosion would receive this radiation dose (625 roentgens) in 15 minutes. However, if a person were behind 30 inches of packed soil or 19 inches of concrete, the radiation intensity would be reduced by a factor of 1,000 and he would receive radiation only at the rate of 2,500/1,000, or 2.5, roentgens per hour. This dose rate would diminish with time, and the chances are that the person behind this shield would not suffer serious effects from the exposure.

## Chemical Weapons

**PHR** The threat of the employment of poison gas as a weapon of war presents a problem which cannot safely be ignored by either military or civil defense planners. This fact is well recognized by the military staffs of all major powers, and it has always been an important consideration in the civil defense programs of the European countries.

Prior to World War II, it could perhaps be accepted that the logistical requirements of long-range air attack with the then known toxic agents provided a margin of safety for the United States. Except for the doubtful event of an enemy securing a beachhead on our shores or in some nearby territory, it seemed unlikely that the citizens of this country would be exposed to the cyanides, the mustards, or the phosgenes.

Developments during and since the war have completely changed the situation. The emergence of the nerve gases, sometimes called G agents, as toxic agents produces a threat to people located anywhere that a plane or guided missile can reach. These agents are in the pos-

session of both democratic and Communist forces. And the extreme lethality of these new organo-phosphorus compounds meets all the logistic requirements for long-range attack. Nerve gas is a killing and disabling instrument—make no mistake about that—and it produces these effects with relatively minute quantities compared to the older compounds.

### Effects of Nerve Gases

Nerve gases, either in the liquid state as loaded in munitions or in the vapor state following shell or bomb detonation, are colorless and virtually odorless. In the vapor form they may attack through the eyes, or they can be inhaled or ingested. In the liquid form they can be ingested, or they may attack systemically through the unbroken skin. The symptomatic effects usually follow this sequence: contraction of the eye pupil, tightness of the chest, labored breathing, nausea and diarrhea, muscular twitching and convulsions, and rapid death unless counter-measures are taken promptly. Death occurs in a matter of minutes for unprotected individuals exposed to lethal concentrations of nerve gas.

These substances are the most powerful enzyme inhibitors known. A nerve impulse reaching a muscle plate produces acetylcholine from the choline and acetate in the tissue. This acetylcholine, which stimulates the parasympathetic nerve system, is normally controlled by cholinesterase. Nerve gases and cholinesterase react irreversibly in the tissue fluid, permitting the acetylcholine level to build up and causing continual stimulation of the parasympathetic nerve system.

Rapid use of blocking agents, such as atropine salts, is required to nullify the effect of the acetylcholine. The atropine salts, usually in the form of the sulfate or the tartrate, are made in ampins or syrettes containing 2 mg. each. Atropine self-injection devices for treatment of nerve gas casualties are being stockpiled by the Federal Civil Defense Administration.

Following exposure to a nerve gas attack, it is recommended that, if pupillary contraction or difficulty in breathing is encountered, an injection of atropine be administered at once. If the symptoms progress rapidly to the convulsive stage, two more injections of 2 mg. each should

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be given immediately. An unconscious person should receive three injections, totaling 6 mg. of atropine, followed by artificial respiration.

Because of difficulties associated with self-treatment, it may be advisable to recommend to the public that atropine injections be given by someone else whenever possible. However, in the event of a successful gas attack, affected persons within the zone of the gas cloud, including those in the impact area and downwind, must be treated promptly to prevent death.

### Detection and Identification

Special kits have been developed by the Chemical Corps of the Army for detecting and identifying chemical agents encountered in the field and for collecting samples for laboratory identification.

If used overtly, chemical agents probably would be disseminated in the form of a cloud set up by aerial attack. We would expect the nature and extent of this cloud to be defined by trained civil defense workers using equipment identical or similar to that employed by the military for detection and identification. Areas contaminated with liquid nerve gas must be clearly marked with warning signs or tapes, since toxic vapor will rise for some time after the actual missile explodes.

Chemical agents might also be used covertly—to contaminate our water or food supplies, for example. Kits have been developed for detection of contaminants in these media, and it is planned to train civil defense public health workers how to use such devices and how to interpret the results.

### Defensive Measures

The havoc a gas attack is capable of producing must receive serious consideration in our civil defense planning. Certainly to ignore these weapons would increase our vulnerability. The use of nerve gases against an ill-informed and unprotected public would create hysteria and panic almost beyond the imagination. Without gas masks or gas-proof shelters, the casualty rate would be enormous.

A gas mask is the only sure protection against nerve gas or any of the other toxic agents that

might be used. At the request of the Federal Civil Defense Administration, the Army Chemical Corps is developing an effective gas mask for use by civilians. The result of several years of research, this mask has several new features. No cannister is used, for example. Instead, there is a so-called diffusion board. One breathes through the sides of the mask rather than through a device attached to the sides or bottom. The mask will have to be made in various sizes to accommodate individual faces. The estimated cost is slightly more than \$2.

Already available is another type of gas mask, which is the approved model for civil defense workers. It is a heavy duty type, very similar to the military mask, for use by rescue and monitoring personnel.

A device to protect preschool-age children and babies, who cannot be fitted with a gas mask, is being developed.

Poor shelter from a gas attack is afforded by ordinary enclosed spaces, such as rooms or buildings. In fact, the danger may increase in such spaces after the cloud passes, since residual concentrations may be trapped within the enclosure. Both exposure time and concentration of the substance are important factors, particularly for agents, such as the nerve gases, which the body cannot detoxify. The same effect may be produced by halving the concentration and doubling the exposure time, for example.

Sealing off openings and cracks in a shelter will help prevent penetration of the vapors. Group shelters from which contaminated air is excluded by filtering devices are feasible.

In summary, modern chemical weapons are extremely toxic and can be delivered upon critical targets in our country. Their physiological action produces characteristic symptoms at such a rapid rate that recognition of the early symptoms serves as an effective means of detection. Protective equipment can be produced. But, until and unless this equipment is available—and it is not today—the United States presents a most attractive target for mass casualty attack with nerve gas. Postattack therapy is possible but of little value without protection for both casualties and first aid personnel.

# Biological Hazards

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Civil defense responsibilities in connection with communicable disease control are so closely related to peacetime activities that major differences exist primarily in emphasis. We have made much progress in the continuing battle against communicable diseases. In a disaster, however, conventional protective measures are likely to be impaired. There is also the possibility of deliberate introduction of disease agents, which may be considered as an adaptation, or perversion, of naturally occurring biological attacks.

Thus, the Public Health Service Communicable Disease Center is able to accept its responsibilities in civil defense by extending and increasing its normal operations. This discussion will be directed primarily toward the investigative activities needed to prepare for wartime health emergencies.

## Natural Disease Outbreaks

In this country, many of the communicable diseases are held in check by the combined effects of a relatively high standard of living and widely employed public health practices of immunization, water treatment, milk pasteurization, environmental sanitation, and good nutrition. The destruction of shelter, water supply installations, and sanitary facilities, the movement or concentration of large population groups, and the lowering of individual resistance by exposure, inadequate or improper diet, and lack of immunization, all of which may be associated with modern war, could reduce our defenses against disease to a primitive state. Such reduction in our defenses could well be followed by an increase in communicable diseases to epidemic proportions. Hence, we must prepare to maintain as far as possible our present methods of control during wartime,

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and we must carry on a continuing search for new and more effective procedures.

The center's current program includes developmental studies in the form of laboratory and field research intended to provide new or better methods for control of diseases. As these methods are field tested, they are demonstrated in State and local areas. Training or assistance with training is provided for professional health personnel. Also, equipment and personnel are supplied to communities in the event of epidemics or disasters which cannot be handled by local resources.

Such activities are in the direct interest of our survival during wartime. The needs of civil defense demand that communicable disease research also look at the exotic diseases and the old diseases which may well be revived under emergency conditions. Thus, civil defense requires a communicable disease program broadened to include all likely occurrences and intensified so that each unit of the public health system can operate effectively during emergencies.

One of the problems that may arise in wartime is the exposure of the surviving human population to disease transmitted by rodents and by insects, such as blowflies, which are not ordinarily associated with disease transmission. The development of a chemical treatment for carcasses to prevent both fly breeding and rodent feeding would be the ideal means of solving this problem. Preliminary studies in the Savannah laboratories of CDC have established the potentiality of protecting bodies from blowfly breeding by use of certain pesticides. Plans are being developed for testing additional pesticides and for improving methods and equipment used in the application of these substances against both flies and rodents.

## Biological Warfare

Certain diseases which may be of relatively little importance in peacetime could assume great significance in biological warfare. Since the majority of biological warfare victims would be those whom the agent reaches directly, it is imperative to know quickly when, where, and what agent was used. Among the most pressing needs in biological warfare defense,

therefore, are rapid and effective means of detecting, recovering, and identifying pathogenic organisms in air, water, and foodstuffs—and possibly in the soil.

Because a likely form of biological attack would be through the formation of aerosol clouds containing pathogenic agents, a prime essential of biological warfare defense is the development of methods and equipment to collect these organisms from the air. Ideally, sampling devices should operate on a 24-hour basis. To reduce to a practical minimum the manpower necessary to operate the devices in this fashion, semiautomatic equipment must be developed.

An obvious corollary to improvement in sampling is the need for methods of rapidly identifying organisms which are considered potential biological warfare agents. Serologic methods have shown the greatest promise to date. Ordinary serologic procedures have the disadvantage of requiring fairly large numbers of organisms and hence a period of time for cultivation of the organisms. A current CDC project concerns methods of identifying pathogenic organisms when only small numbers are present. Promising results have been obtained in preliminary studies with fluorescein-tagged antibodies. In this technique, high-titered antiserums, specific for pathogenic organisms which are considered potential biological warfare agents, are developed in laboratory animals. The antiserums are then associated by chemical means with a fluorescent compound. When homologous organisms and fluorescein-tagged antibodies are combined, the organisms will fluoresce under ultraviolet light.

### Chemical Warfare

Although communicable disease control would not appear to be directly related to defense against chemical warfare, actually certain principles and activities are parallel. Since 1949, the Communicable Disease Center has been making extensive studies of insecticides, including the organic phosphorus compounds which are chemically related to and produce essentially the same physiological effects as the nerve gases. These studies have included field and laboratory investigations concerned with

toxicity of the compounds under varying conditions, detection and prevention of hazards involved in their use, and treatment of workers exposed to them. Much of the information gained is applicable in civil defense against chemical warfare agents.

Supplementary investigations specifically designed to meet civil defense requirements are needed, however. Problems that should be studied include: development of automatic devices and techniques for rapid detection of nerve gases and feasibility of including such equipment as an integral part of the automatic public warning system; inactivation of nerve gas aerosols by means of counteraerosols or smokes containing mild alkali; effectiveness of protective devices and clothing against nerve gases; persistence of toxic substances on foods and surfaces; decontamination techniques for buildings, clothing, and environment; rapid screening for cholinesterase determinations; and treatment of poisoned persons.

## Sanitary Engineering



Civil defense research activities of the Robert A. Taft Sanitary Engineering Center are of the type for which its facilities and staff are well suited. Progress in the projects assigned late in 1954 is summarized here.

### Water Supply Protection

Research concerning protection of water supplies has two primary aims: (a) to develop feasible methods of reducing the hazards to water supplies from overt or covert attacks with biological, radiological, and chemical agents and (b) to develop methods for supplying safe potable water during emergencies.

The plan for accomplishing the first of these aims calls for:

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1. Evaluation of the hazards to water supply sources of enemy attack with the various special agents.

2. Additional laboratory investigations of the ability of water treatment processes to remove or inactivate various agents.

3. Development of new or improved methods of removing or inactivating these agents.

4. Field trials of the methods developed.

The plan for accomplishing the second aim includes:

1. Determination of needs for emergency water treatment facilities, particularly in areas to which people will be evacuated from target cities.

2. Development of the simplest and least expensive, but reliable, emergency treatment methods.

Several projects already under way are providing valuable information concerning protection of water supplies. One, which is under the sponsorship of the Bureau of Yards and Docks of the Navy, is aimed at developing design criteria and operating instructions for protection of naval continental shore base water supplies from biological, chemical, and radiological agents. We are also studying the ability of existing municipal water treatment methods to remove various concentrations of coliform organisms from raw water; the fate of fallout in the environment after atomic bomb tests; and disinfection materials and techniques. Tentative findings concerning the hazards to water supplies of the various special agents follow.

### *Biological Agents*

A number of biological agents will effectively contaminate water, and the use of these agents by saboteurs is a distinct possibility. Every house connection, every fire hydrant is a possible point of entry by a contaminant. Policing of a large municipal water distribution system to prevent such contamination is out of the question.

The exact quantity of material required to produce an infectious dose of the various biological agents is not known, but it is estimated from limited information on oral infectious doses that 1 to 10 pounds of material would be sufficient to contaminate a million gallons of

water. Each cupful of this million gallons would contain an infectious dose.

We see no way of protecting municipal water systems against a determined saboteur. However, we believe that entire cities would not be attacked. It seems more probable that bacterial sabotage would be directed against critical industrial, military, or other particularly vital elements of a city. Re-treatment of water, provision of an auxiliary supply, or storage near the point of use are the only sure means of protecting against such sabotage. Our studies are aimed at determining how much treatment may be needed, whether disinfection alone will suffice, or whether more complete treatment must be provided.

Detection of biological agents in water is likely to be too slow to prevent infection. As yet, too little is known about the normal variation in chlorine residual in municipal distribution systems to warrant use of chlorine residual measurements for monitoring water for presence of contaminants. Visual detection of bacterial contamination is not feasible because of the high concentrations of organisms that would be required.

Knowledge of the ability of water treatment processes to deal with biological contaminants is extremely limited. We know that chlorine in concentrations of less than 1 p.p.m. will deal effectively with contamination by vegetative bacteria if the chlorine is not in a combined form. We know the chlorine requirements for killing the cysts of certain protozoan parasites. But little is known about the ability of water treatment processes to remove viruses or rickettsiae, or the chlorine doses necessary to kill certain spore-forming bacteria, or methods for removing or detoxifying organic toxins.

### *Chemical Agents*

The standard chemical warfare agents are relatively unattractive as intentional water contaminants. The nerve gases, for example, although among the most toxic chemicals known, are considered less of a danger than some of the biological agents. Their toxic effects are exhibited so promptly and so dramatically that their presence would be suspected as soon as a few people had used the water.

Methods for removing nerve gases from wa-



ter have been developed by the Chemical Corps of the Army and tested by the Corps and the Army's Engineer Research and Development Laboratory. These gases hydrolyze readily at high pH values. Hence, in the event of incidental contamination of water supplies as a result of missiles containing chemical agents falling into the water system, adjustment of the pH to about 10 will lead to the hydrolysis of nerve gases to relatively nontoxic products within a comparatively short time. A method for detecting nerve gases has also been developed by the Chemical Corps, and kits for use in detecting these and other chemical agents in water are available.

The possibility exists, of course, that chemical agents unknown to us are available to an enemy. If other materials do become known, it may be necessary to revise our estimate of the hazard of chemical agents to water supplies.

Development of a monitoring device that will detect any chemical agent and perhaps some toxins may be possible. We are now studying the use of fish, which are much more sensitive than humans to toxic chemicals, as detectors.

### *\* Radiological Agents*

Although radioactive materials are not considered probable intentional contaminants, there are hazards to water supplies from the radioactive fallout produced by an atomic explosion. Thermonuclear weapons may be detonated at levels which give rise to considerable fallout. However, to what extent these weapons will affect water supplies, we are not ready to say. It is certain that the hazards associated with the use of water contaminated by man-made radioactive elements will not decrease as rapidly as the radioactivity in the water decreases, because the most dangerous of the radioisotopes from the standpoint of internal use have relatively long half-lives. Some water sources may remain dangerously contaminated long after external exposure to radiation from fallout on the ground has declined to tolerable levels.

Additional information on the physical and chemical characteristics of the fallout material is needed to help evaluate the hazards to water supplies. The Public Health Service and

others have shown that standard water treatment processes are of limited use in removing soluble radioactive materials. The hazardous isotopes, particularly those of strontium, barium, and iodine, do not respond well to standard water treatment processes. If water supplies are heavily contaminated with these materials, and if the elements are not so closely associated with particulate matter as to be removed with the particles, expensive treatment, such as ion exchange or distillation, will be required to restore safety to drinking water.

### **Food Protection and Decontamination**

One of the first problems following an attack with biological, chemical, or nuclear weapons will be to provide safe food to the surviving population. The Public Health Service shares the responsibility for planning to meet this problem with the Department of Agriculture and the Food and Drug Administration. The Public Health Service area of planning includes the protection and sanitation of milk supplies and other foods in retail markets, restaurants, other public places, and in the home.

Research needs fall into four principal categories: (a) rapid procedures to distinguish the nature of the contaminant; (b) means for preventing or eliminating contamination by biological and chemical aerosols and radioactive fallout; (c) practical decontamination procedures for foods; and (d) problems of sanitation and emergency storage of foods needed for mass feeding of displaced persons.

Emergency decontamination of other essential items (food containers or packages, eating and drinking utensils, clothing, and bedding) and of the person and the shelter area is also being studied. Under some conditions and for some items, routine cleansing with soapy water may be the most important phase of decontamination. Information will be obtained on the probable kinds, amount, and persistence of contaminants, as well as the effectiveness of available decontaminants under emergency conditions.

### **Rapid Identification Methods**

We are seeking to adapt membrane filter procedures and infrared spectrophotometry for use



in the rapid isolation and identification of bacteriological agents from mixed bacterial populations.

When dried smears of bacterial cells are subjected to infrared spectrophotometry (wave length  $5\mu$  to  $12\mu$ ), characteristic and identifying spectra are obtained. The characteristic absorptions are reproducible within plus or minus 2 percent, provided the bacterial cells are grown under carefully controlled conditions and provided the infrared spectrophotometer is carefully set, balanced, and operated. The spectrographic data can be transferred to punch cards and identification readily established by matching unknowns with knowns. The procedure can be accomplished within a few hours after sufficient bacterial cells are available. At the present time, about 1 mg. of cells is required, but recent developments indicate that satisfactory spectra may be obtained on as little as 0.1 or possibly 0.01 mg. of cells.

Bacterial cells grow on the membrane filter in 10 to 20 hours. The time required depends on the specific organism and other factors. Because the filter is an efficient means of concentrating the organisms from dilute suspensions in fluid or gaseous menstrua and because the organisms grow in situ, membrane filter procedures offer time advantages over conventional fluid or agar media in the production of pure colony growths from mixed populations. By transfer of single colony growths to standard medium, followed by 6- to 8-hour incubations, sufficient pure culture cells for infrared spectrophotometry become available.

We believe that, by using a relatively few (4 to 6) basic differential media, the potential bacterial pathogens can be grown on the membrane filter and tentatively differentiated from non-pathogenic species. Incubation of suspicious colonies on a standard medium for a few hours will supply sufficient cells to allow completion of identification by infrared spectrophotometry. We believe this procedure is capable of detecting and identifying pathogens present in relatively small numbers, even when they are mixed with relatively large numbers of nonpathogenic organisms. The entire process of detection, isolation, and identification could take less than 30 hours.

The available information regarding the detection and identification of chemical agents is being reviewed, with emphasis on the nerve, cyanogenous, mustard, and arsenical gases.

## PHS Responsibilities



Prompted by the reasoning that public health phases of civil defense should be "built in" with existing public health programs, the Federal Civil Defense Administration delegated public health civil defense responsibilities to the Department of Health, Education, and Welfare on July 14, 1954. It was felt that the Public Health Service could carry out these responsibilities efficiently and economically through well-established channels. It was recognized, further, that civil defense will be a long-range activity and that it therefore requires continuing program attention.

The following functions have been assigned to the Public Health Service:

1. Plan a national program, develop technical guidance for the States, and direct Federal civil defense activities concerned with research relating to the detection, identification, and control of: (a) communicable diseases in man, (b) biological warfare against man, (c) chemical warfare against man, and (d) other public health hazards.
2. Plan, develop, and direct Federal activities concerned with a national program designed to provide Public Health Service reserve personnel from support areas to areas damaged by enemy attack.
3. Plan, develop, and distribute, through appropriate channels, technical guidance concerning the provision of shelter and other protective measures designed to minimize injury to personnel and to reduce damage to vital functional components of public health facilities.
4. Plan a national program, develop technical guidance for States, and direct Federal

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*By Leroy E. Burney, M.D., an Assistant Surgeon General of the Public Health Service and deputy chief of the Bureau of State Services.*

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activities concerned with emergency restoration of community facilities essential to health or functional components thereof for which the Public Health Service normally has operating programs.

### Planning Assumptions

The Public Health Service civil defense work program for fiscal year 1955 was based on the FCDA planning assumptions for that year. The highlights of these assumptions are:

1. An enemy has the capability of striking any target in the United States.

2. Such attack, if it comes, will consist principally of nuclear (including thermonuclear) weapons delivered by air. These weapons might be delivered by submarines, or they might be smuggled in.

3. Additional weapons, requiring special measures to meet large-scale attacks, will be biological and chemical agents.

4. High-explosive and incendiary bombs are also possible weapons.

5. Preparation must be made to meet psychological warfare and sabotage. Sabotage may include attempts to disrupt industries and communications and covert attacks with biological and chemical agents.

6. The initial attack will be in the nature of an attempted knockout blow, but recurring attacks may be expected.

7. The size of the bombs will range from a few thousand tons to millions of tons of TNT equivalent. One bomb will be sufficient to destroy the largest city.

8. Approximately 1 hour's warning will be received in most areas—possibly less time in some coastal areas and more time in inland areas.

9. Mass evacuation of target cities will provide the best means of reducing casualties.

10. Any area attacked will require outside support; mutual aid will be helpful but it will not be sufficient alone. Both mobile and fixed support from the State attacked, other States, and Federal sources will be required.

We understand that many of the 1955 assumptions, such as the probability that biological and chemical weapons, as well as nuclear weapons, will be used against us, will be carried over

to the planning assumptions for fiscal year 1956. However, a major change is expected as a result of the recent Atomic Energy Commission release concerning radioactive fallout from explosion of a thermonuclear bomb. The release emphasized that it is not possible to apply a single fallout pattern to all thermonuclear detonations. This is true even under test conditions, when the bomb size is known, since the nature of the ground where the explosion occurs, the size of the resulting particles, and the variable directions and velocities of the winds at different levels all have to be considered. With adequate knowledge of atmospheric conditions, however, the fallout pattern usually can be predicted with considerable accuracy.

In the Bikini test of March 1954, the area of extreme hazard from fallout was up to 20 miles wide and 140 miles long downwind from the explosion and about 20 miles upwind and crosswind. The area of some hazard extended approximately 100 miles farther downwind and 20 miles farther to the sides.

### Outline of the PHS Program

The Office of the Surgeon General has the overall responsibility for civil defense planning and program development in the Public Health Service. In addition, this office is conducting a project concerning the adaptability of military chemical warfare defenses to civil defense needs.

The National Institutes of Health are conducting investigations designed to lead to improvement of vaccines and other immunizing procedures. Some of their research is directed toward the development of better adjuvants and the determination of effects of known adjuvants with different vaccines. They are also studying preparation and evaluation of purified antigens in experimental animals and the effects of combined antigens in reduced amounts. The goal for this year is to determine whether or not combinations of certain antigens will produce adequate immunization in experimental animals and the minimum amounts that will produce satisfactory immunity. (Since the date of the civil defense conferences, this work has been suspended temporarily.)

The Bureau of State Services will keep the

States informed of the results and means of application of all research relating to biological and chemical warfare hazards and other public health problems. Upon request from the States, the Bureau will provide training courses for key health personnel and for trainers, who, in turn,

can train others. To the limit of its resources, the Bureau will provide assistance in planning State studies and operations. The Public Health Service regional offices will be the channel between the Public Health Service and the States.

## Glossary of Radiation Terms

**Alpha particle:** Charged particle, having a mass of 4 units and 2 unit positive charges of electricity, which is emitted from the nucleus of some atoms. It is composed of 2 neutrons and 2 protons.

**Alpha ray:** Stream of fast-moving alpha particles. It is a strongly ionizing and weakly penetrating radiation.

**Atom:** The chemical unit of which all matter is made. It is the smallest particle of an element capable of entering into a chemical reaction.

**Atomic radiation:** Radiation produced by energy changes in atomic nuclei or atomic electron clouds; ionizing radiation.

**Background radiation:** Ionizing radiation produced by cosmic radiation and naturally occurring trace amounts of radioactive elements.

**Beta particle:** Charged particle, having a mass and charge equal in magnitude to those of the electron, which is emitted from the nucleus of some atoms.

**Curie:** Standard measure of the rate of radioactive decay; the quantity of any radioactive substance in which the number of disintegrations per second is  $3.7 \times 10^{10}$ . The radioactivity of 1 curie of a substance is comparable to the radioactivity of 1 gram of radium.

**Decay:** Disintegration of the atomic nucleus of an unstable element by the spontaneous emission of charged particles or protons or both.

**Electron:** Negatively charged particle which is a constituent of every atom; unit of negative electricity equal to  $4.80 \times 10^{-10}$  electrostatic units. Its mass is about  $\frac{1}{2000}$  of that of a proton.

**Electron volt:** Amount of energy gained by an electron in passing across a potential difference of 1 volt.

**Equivalent roentgen:** Amount of radiation which produces in air an amount of ionization equal to that produced by 1 roentgen of X-radiation or gamma radiation.

**External radiation:** Radiation entering the body from without.

**Fallout (radioactive or atomic):** The radioactive dust and atomic or hydrogen bomb debris that falls to the ground downwind from an atomic explosion.

**Film badge:** Small piece of X-ray or similar photographic film enclosed in a lightproof paper, usually crossed by lead or cadmium strips, carried in a small metal or plastic frame. It is used to estimate the amount of radiation to which an individual has been exposed.

**Gamma ray:** Electromagnetic radiation emitted from the nucleus of a radioactive atom.

**Half-life:** Time required for a radioactive substance to lose by decay 50 percent of its activity.

**Internal radiation:** Radiation produced inside the body from a radioactive substance assimilated and contained within the tissues.

**Ion:** Atomic particle, atom, or chemical radical (group of chemically combined atoms) bearing either a positive or negative electrical charge caused by an excess or deficiency of electrons.

**Ionization:** Act or result of any process by which a neutral atom or molecule acquires either a positive or negative electric charge.

**Ionizing radiation:** Radiation possessing sufficient energy to ionize the atoms or molecules absorbing it.

**Isotope:** Any of two or more forms of an element having the same atomic number (nuclear charge) and hence occupying the same position in the periodic table. All isotopes of an element are identical in chemical behavior but are distinguishable by small differences in atomic weight. The nuclei of all isotopes of an element have the same number of protons but differ in the number of neutrons.

**LD<sub>50</sub>:** The dose of radiation which will cause death to approximately 50 percent of the members of a given animal species, usually within 30 days; the median lethal dose of radiation.

**Mass unit:** Unit of mass which is  $\frac{1}{16}$  the mass of an oxygen atom taken as 16.00000.

**Maximum permissible dose:** The maximum dose of ionizing radiation that, in the light of the present knowledge, is not expected to cause appreciable bodily injury to a person at any time during his life.

**Microcurie:** A millionth of a curie; the quantity of any radioactive substance in which the number of disintegrations per second is 37,000.

**Millicurie:** A thousandth of a curie.

**Neutron:** Nuclear particle which is electrically neutral. Its mass is approximately the same as that of a proton.

**Nuclear reactor:** A device or machine for producing energy by fission or fusion of atomic nuclei.

**Permissible dose:** A dose of ionizing radiation that, in the light of present knowledge, is not expected to cause appreciable bodily injury to a person in any time during his life.

**Proton:** Nuclear particle with a positive electric charge equal numerically to the charge of the electron. Its mass is 1.007575 mass units.

**Radiation sickness:** The group of symptoms developed consequent to an overexposure to ionizing

radiation. The symptoms include weakness, nausea, vomiting, diarrhea, leukocytopenia, anemia, and spontaneous bleeding.

**Radioactivity:** Characteristic of certain kinds of matter, the atomic nuclei of which are unstable and undergo spontaneous disintegration with liberation of energy. The disintegration process, which usually results in the formation of new elements, is accompanied by the emission of one or more types of radiation, such as alpha particles, beta particles, and gamma rays.

**Radiosotope:** A radioactive isotope.

**Radiological health:** The public health aspects of the use of ionizing radiation.

**SD<sub>50</sub>:** The dose of radiation which will cause radiation sickness to approximately 50 percent of the members of a given animal species.

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## Approval Withdrawn for Three Food Dyes

The Food and Drug Administration has removed three widely used coal tar dyes from the certification list of approved coloring materials which may be added to food. The law requires that food colors be certified as completely harmless.

The three colors involved, FD & C Orange No. 1, Orange No. 2, and Red No. 32, are harmless in the amounts ordinarily consumed in foods, but recent scientific investigation shows they are not harmless when taken in large amounts.

Orange No. 1 has been widely used in candy, cakes, cookies, carbonated beverages, desserts, and meat products, especially frankfurters. Orange No. 2 and Red No. 32 have been used in coloring the outer skin of oranges.

While manufacturers may no longer label and sell these three colors for food use, all three colors have been added to the list that may be certified for external drug and cosmetic use.

These colors will no longer be certified for internal use after February 14, 1956. The law does not prevent use of stocks previously certified.

# Tuberculosis Morbidity and Mortality Facts and Trends

By ROBERT J. ANDERSON, M.D.

THE IMPACT of tuberculosis on our population has undergone remarkable changes in the recent past. Deaths from tuberculosis continue to decline, and illness is somewhat less frequent and of shorter duration. Current facts and trends may make clear some of the directions effort must take to accomplish a continuing control of tuberculosis.

The complexity of morbidity reporting limits good detailed data on the subject to recent years. Mortality data, however, being simpler to collect if not as rich in meaning, are available in much longer series and much more detail.

The number of deaths (fig. 1) from tuberculosis has declined between 15 percent and 20 percent each year for the last few years. In spite of this decline, provisional tabulations show that for 1954 there were 17,000 deaths from tuberculosis in the United States, a rate of 10.5 per 100,000 population. For the first quarter of 1955, the decline appears to be somewhat retarded, with a death rate about 10 percent less than that in the first quarter of 1954.

Deaths measure only one aspect, though an important one, of the impact of tuberculosis upon our population. The death rate has never

been a precise index of the trend of the tuberculosis problem, and today its usefulness is more limited than in former years. But, in recognizing the limitations of mortality as an index of trends, its usefulness as an indication of the relative influence of the disease on various population groups should not be ignored.

The number of new cases reported now constitutes one of the best indexes of the trend of tuberculosis although a decade ago reporting was so inadequate in many places as to make this measure virtually useless. In the last several years there has been approximately a 8 percent decline in the number of new cases reported per year. At this rate, more than a quarter century will be required to equal the same percent reduction realized in mortality in the last 5 years alone. The prospect of even this achievement is beclouded by one recent observation. Preliminary morbidity reports for the first 3 or 4 months of 1955 from two-thirds of the United States show an increase of 2 percent in new tuberculosis cases. A portion of this increase may be due to additional case finding. There is need for further study to determine whether there are other reasons for the increase.

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*Dr. Anderson, assistant chief for operational research, Division of Special Health Services, Public Health Service, presented this paper at the annual meeting of the National Tuberculosis Association, held at Milwaukee, May 26, 1955.*

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## Tuberculous Meningitis

Tuberculous meningitis, not to be compared with respiratory tuberculosis in the number of lives it has taken, has nevertheless been an important index of the degree of control of the

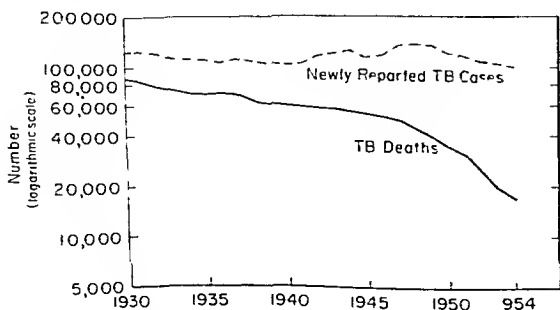
whole tuberculosis problem. A low tuberculous meningitis death rate has been considered an index of success in preventing the spread of the tubercle bacillus. Two-thirds of such deaths occur among children under 15. From 1900 to 1920, there was little decline in tuberculous meningitis death rates. From 1920 to 1940, the drop was almost precipitous, as compared with the gradual decline in respiratory tuberculosis rates. This was about the time when the number of tuberculosis beds began to climb. It was a matter of considerable concern that from 1944 to 1950 there was a leveling off in the number of deaths due to tuberculous meningitis. Fortunately, there has been a substantial decline in the last 3 years, doubtless because of improved techniques of present-day drug therapy.

Now that the case-fatality rate for tuberculous meningitis has been dramatically reduced, this death rate is no longer a useful index of the adequacy of a tuberculosis control program. Accurate data on the incidence of tuberculous meningitis, however, would still be a useful index for that purpose.

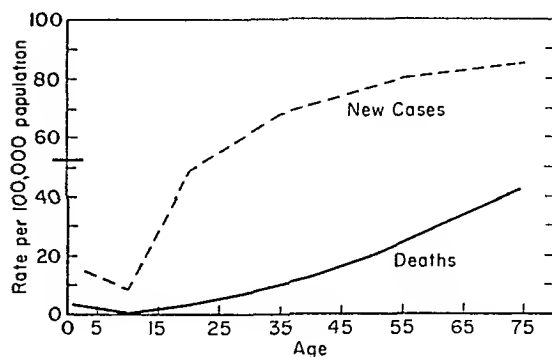
#### Age, Sex, and Race

Tuberculosis as a disease is still very much a foe of young adults (fig. 2). Although the rate is low in children, it rises sharply in the 15- to 24-year age group and continues to increase gradually with age. For the entire United States half of the newly reported active cases are patients under 42 years of age. Thus the frequency of the disease among young adults who respond very favorably to present-day drug

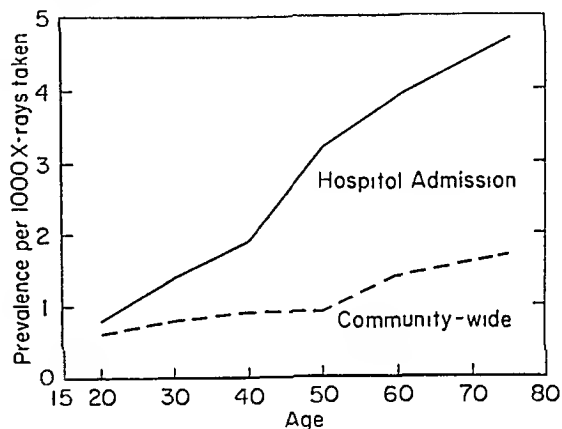
**Figure 1. Newly reported tuberculosis cases and tuberculosis deaths, United States, 1930-54.**



**Figure 2. Age-specific rates for newly reported active and probably active tuberculosis cases and tuberculosis deaths, United States, 1953.**



**Figure 3. Active tuberculosis cases per 1,000 X-rays taken in communitywide and hospital admission X-ray programs.**



therapy is a matter of significance for tuberculosis program planning.

While a large proportion of all tuberculosis cases are reported among the younger part of our population, the case rates are higher in the older age groups. Moreover, the rates of newly reported tuberculosis cases for older people show little decline from year to year. In fact, in the age 65 and over group, a slight increase was shown for 1953. High morbidity rates for those in the older age groups are also found in communitywide surveys and in hospital admissions X-ray screening programs (fig. 3).

In the past half century (fig. 4) the decline in tuberculosis mortality by age has been most marked in infants under 1 year of age. In the first decade of the century, infants under 1 year of age had a higher tuberculosis death rate than

# Tuberculosis Morbidity and Mortality

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Deaths measure only one aspect, though an important one, of the impact of tuberculosis upon our population. The death rate has never

been a precise index of the trend of the tuberculosis problem, and today its usefulness is more limited than in former years. But, in recognizing the limitations of mortality as an index of trends, its usefulness as an indication of the relative influence of the disease on various population groups should not be ignored.

The number of new cases reported now constitutes one of the best indexes of the trend of tuberculosis although a decade ago reporting was so inadequate in many places as to make this measure virtually useless. In the last several years there has been approximately a 3 percent decline in the number of new cases reported per year. At this rate, more than a quarter century will be required to equal the same percent reduction realized in mortality in the last 5 years alone. The prospect of even this achievement is beclouded by one recent observation. Preliminary morbidity reports for the first 3 or 4 months of 1955 from two-thirds of the United States show an increase of 2 percent in new tuberculosis cases. A portion of this increase may be due to additional case finding. There is need for further study to determine whether there are other reasons for the increase.

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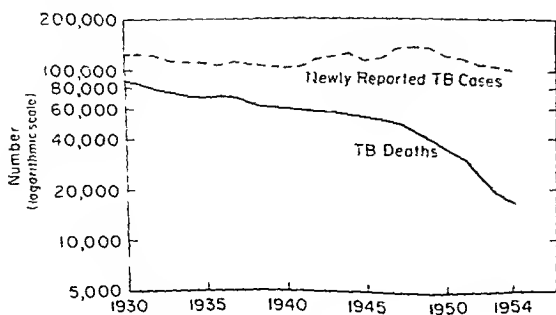
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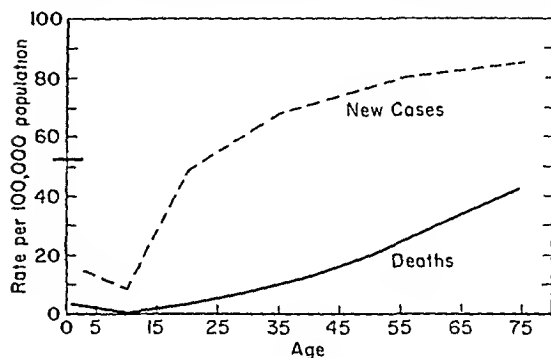
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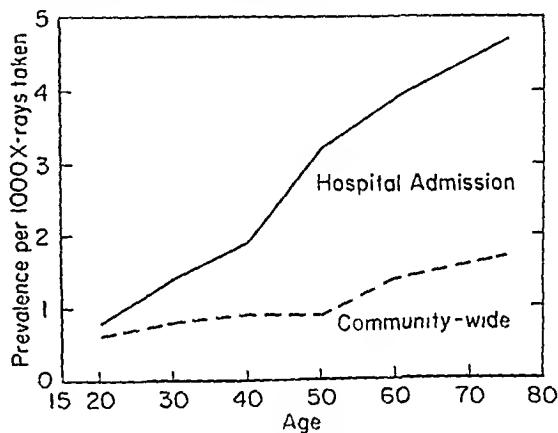
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Tuberculous meningitis, not to be compared with respiratory tuberculosis in the number of lives it has taken, has nevertheless been an important index of the degree of control of the

economic status is examined, this relationship is not so marked. For example, in a study made in Cleveland, Ohio, it was learned that tuberculosis mortality was almost 20 times as great in the lowest economic group as in the highest (fig. 8). However, previously unknown tuberculosis cases in the lowest economic group were only about 1.5 times as great as in the highest. It seems reasonable, therefore, to conclude that low economic status and tuberculosis each tend to beget the other.

This suggests the need for study of the social, psychological, economic, and nutritional factors which have been recognized as being important in the development of tuberculosis. It also suggests the need for directing case-finding activities. It is not sufficient to search for cases among the population groups which have the highest death rates. It is better to search among the groups with the highest prevalence rates, but undue emphasis may result in missing the large number of cases in those groups that have lower prevalence rates but large numbers of people.

### Geographic Distribution

Tuberculosis death rates generally are high in the large cities. Cities of 100,000 population and over have a tuberculosis death rate approximately 80 percent higher than that of the remainder of the country. In fact, when the death rates for each State, exclusive of the large cities, are computed, there are only four States—Arizona, Tennessee, Arkansas, and Kentucky—which have death rates higher than the average

rate for the large cities. Maryland is one of the States with a fairly high tuberculosis death rate, yet, when Baltimore is excluded, its death rate in 1953 was below 10 per 100,000 population. Maryland exclusive of Baltimore has a lower rate than do any of the States nearby with their large cities excluded. When the large cities in Michigan, Wisconsin, and Minnesota are excluded, those States compare quite favorably with the other middle western States and the Mountain States exclusive of large cities. People who live in the suburbs have a death rate less than half the rates in the large cities. Small cities, unincorporated urban areas, and rural areas have the lowest rates.

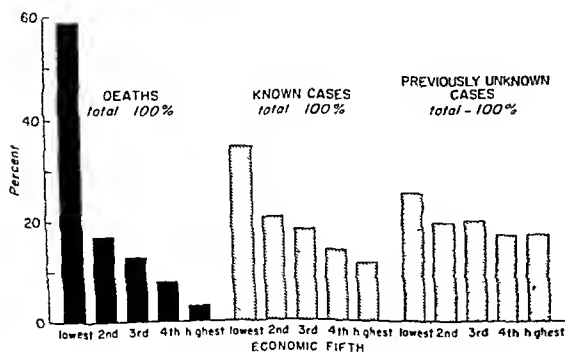
Morbidity rates are lowest in some of the States in the western plains and Rocky Mountains. A fairly close parallel exists between reported cases and deaths by States (figs. 9 and 10). The decline in mortality has been without any apparent geographic pattern (fig. 11). Some States which had low tuberculosis death rates in 1947 also had the least percentage decline, while other States with moderately low death rates showed the greatest improvement. A similar variation in decline occurred in the group of States with high death rates.

### Case Finding and Reporting

The relative slowness with which the rate of newly reported cases has declined has been the object of considerable curiosity. Reporting was very inadequate in many States before 1947, and during the period 1947 to 1949 morbidity reporting was inflated by the inclusion of cases of borderline clinical significance. For recent years, however, rates of newly reported cases are generally not inflated. The evidence for this is twofold: First, approximately 37 percent of new active cases had positive sputum at the time of report; second, 78 percent of the cases were reported as either moderately advanced or far advanced. There is no appreciable change from the preceding decade.

Further evidence of the persistently high incidence of tuberculosis is in the number of admissions to tuberculosis hospitals. These have done little more than fluctuate in the period from 1947 to 1953 in several large States for which data are available. Vacancies in beds are

**Figure 8. Percentage distribution of deaths from tuberculosis, known cases and previously unknown cases, by economic fifth, Cuyahoga County, Ohio.**



any other age group. In recent years this group has had a lower death rate than has any of the adult age groups.

From 1930 to 1950, there was relatively little drop in tuberculosis death rates in the older age groups, but in the last few years, the decline has been quite marked. Even more rapid has been the decline in death rates for those under 25.

Rates of newly reported active cases of tuberculosis by sex and race continue to demonstrate somewhat the same pattern as in former years. Rates for white males are approximately twice those for white females. Rates for nonwhites are approximately three times as high as for whites. Yet, in six States, the tuberculosis case rates are higher for white males than for nonwhite females, and further, the number of cases reported for white males (fig. 5) is almost as great as the number for the other three groups combined.

The proportionate decline in death rates has been much greater in recent years among fe-

Figure 4. Age-specific tuberculosis death rates, United States, 1900-1953.

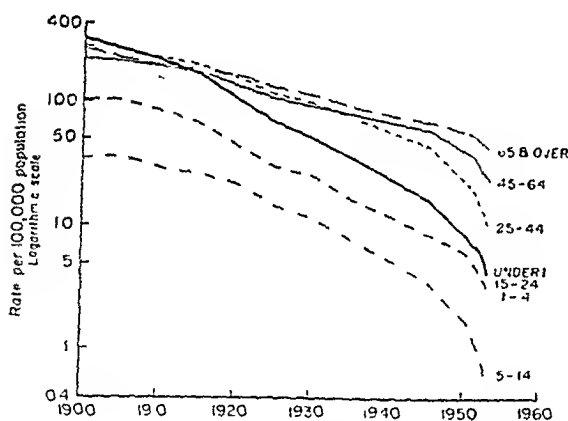


Figure 5. Race and sex of newly reported active and probably active tuberculosis cases, United States, 1953.

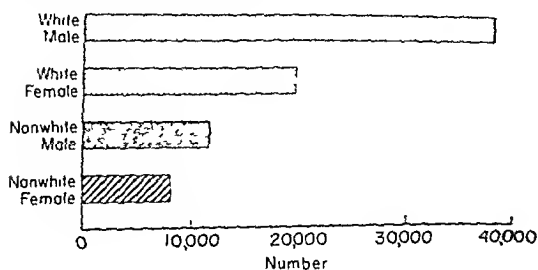


Figure 6. Race and sex-specific tuberculosis death rates, United States, 1940-54.

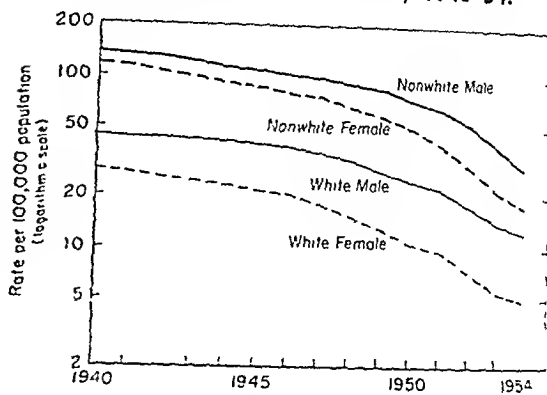
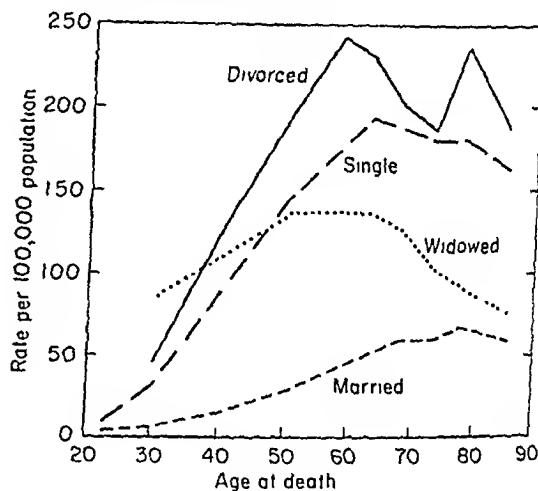


Figure 7. Marital status, age-specific tuberculosis death rates for white males, United States, 1949-51 average.



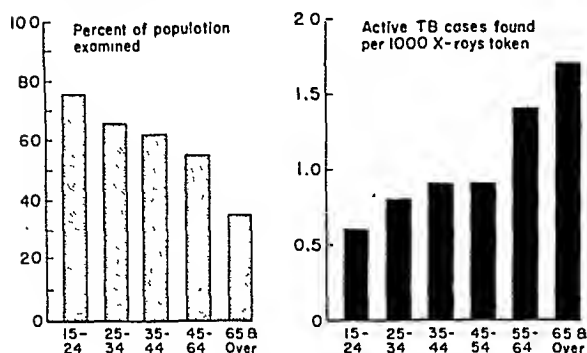
males than among males (fig. 6). If this trend continues for another 5 years, white males will have a higher tuberculosis death rate than nonwhite females.

### Marital and Economic Status

Generally, death rates from all causes are definitely higher for the unattached than for the married (fig. 7). Tuberculosis death rates are much higher for single, widowed, and divorced people than for married persons.

The close relationship between tuberculosis mortality and economic status has been generally recognized. However, when the prevalence of unreported tuberculosis in terms of

**Figure 12. The age groups with the most tuberculosis not reached in communitywide chest X-ray surveys.**



leaves a fine line between minimal and moderately advanced disease.

With the emphasis upon reporting active and probably active cases, there is a built-in bias against the reporting of minimal tuberculosis cases. From a practical viewpoint, treatment is not recommended for the minimal inactive cases.

In spite of the difficulties of diagnosing tuberculosis before it has extended, it is still the responsibility of tuberculosis control workers to put forth all possible efforts to use effectively the presently available means for diagnosis. For example, communitywide surveys and other X-ray case-finding programs have generally been successful in the various States, and many millions of people have been X-rayed. However, the surveys have not been as successful as might have been hoped (fig. 12). The older age groups in which the rate of active tuberculosis is greatest have not been adequately covered.

### Prevalence

Current information indicates that there are somewhat less than 400,000 active tuberculosis cases in the United States at any one time, approximately one-third of which are hospitalized for tuberculosis, one-third are known cases at home, and one-third are undetected cases.

Several studies in progress indicate that the total number of known active cases is definitely declining. How great this decline is cannot now be accurately measured; but some precise in-

formation is available concerning known tuberculosis cases hospitalized at any one time, or the beds the patients occupy. On April 1, 1954, there were 2 percent fewer patients hospitalized for tuberculosis than a year earlier. A study by the National Tuberculosis Association and the Public Health Service, in November 1954, of a large number of tuberculosis hospitals shows a further decline of 6.7 percent. However, the number of patients hospitalized for tuberculosis in November 1954 was greater than at any time prior to 1950.

The number of known active cases at home appears to be declining. Before the days of chemotherapy, the majority of patients discharged from sanatoriums continued to have active disease at home for a substantial period of time. Today, most patients discharged from the sanatorium are discharged with arrested or inactive disease. A substantial proportion of these patients continue to receive chemotherapy at home for a period of months or years after sanatorium discharge. Thus, even though the number of known active cases at home may be declining, the demands upon health department services are actually increasing. These cases, arrested but continuing on drug therapy, will actually require more public health supervision from health department staffs, public health nurses in particular, than corresponding patients received a decade ago. Current studies show a very marked inadequacy of public health supervision and treatment of the known tuberculosis cases who are at home. Although the prevalence of tuberculosis in unattached males, migrants, and other special groups presents a challenging problem, there are numerically more known tuberculosis cases at home in other categories who are not getting control services.

### Infection Rates

The number of persons infected with tubercle bacilli is not known. Relatively little of the tuberculin testing now being done provides adequate information concerning infection rates. Several studies are in process and are being planned for this purpose. One such study in the District of Columbia shows an infection rate of only 3 percent for 7-year-old children of all races combined. It is certain, however, that

Figure 9. Newly reported active and probably active tuberculosis cases per 100,000 population (provisional data), United States and Territories, 1954.

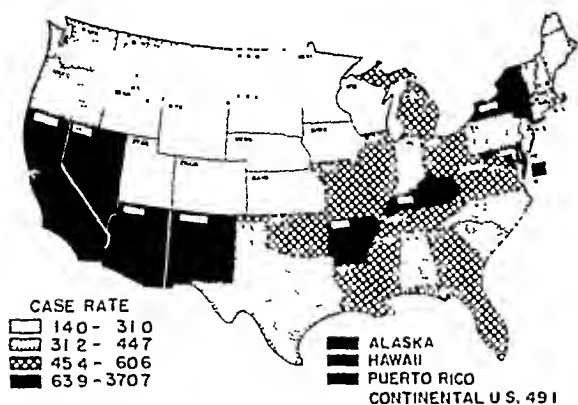
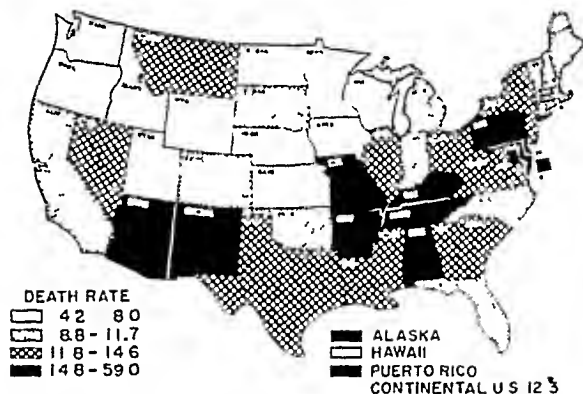


Figure 10. Tuberculosis deaths per 100,000 population, United States and Territories, 1953.



probably due more to reductions in duration of stay than to decreases in admissions.

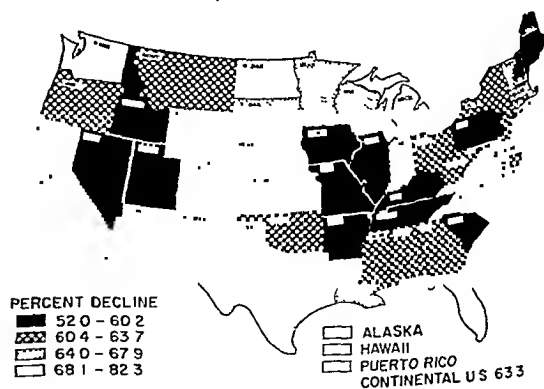
Tuberculosis case finding and reporting now are definitely superior to that of previous decades. For example, almost one-third of reported cases are found by X-ray survey. Fewer cases are first reported by death certificate. Even now, however, more than one-fourth of tuberculosis deaths were never reported as living cases. Large numbers of cases are not reported until the report of the sanatorium admission is received by the health department. The number of cases that remain unreported because they are not referred for sanatorium admission is not known. While progress has been made in reducing the proportion of cases first reported in the far-advanced stage to 37 percent,

it would seem reasonable to expect a further movement of reported cases from the far-advanced category to the moderately advanced category provided case-finding and case-reporting efforts are not relaxed.

Usually cases are diagnosed as tuberculous before they are referred for hospitalization, and in such instances the cases should be reported to the health department by some source other than the tuberculosis sanatorium. Even so, in 10 States, 40 to 60 percent of the reports of new active cases come from the sanatorium. It is at least questionable that the reporting systems in these States are adequate. In any event, the reporting of cases should be evaluated in the light of the specific practices in any given area.

To find as many cases in early stages of the disease as possible is a most worthwhile and desirable goal, but it is questionable that early case finding can be judged solely in terms of the proportion of new cases which are minimal in extent. The duration of time in which tuberculosis may progress from minimal to advanced may be very short, and present-day diagnostic procedures are such that it is difficult to discover active cases before they become moderately advanced. In order to prove tuberculosis by demonstration of tubercle bacilli from sputum, or gastric or bronchial lavage, necrosis of the lung must have set in, which means that a cavity is being formed. When a cavity can be seen on an X-ray, the case is no longer minimal in extent but must be classified at least as moderately advanced. Obviously, this frequently

Figure 11. Percentage decline in tuberculosis deaths per 100,000 population, United States and Territories, 1947-53.



## Threshold Limit Values for 1955

Values are given in the following tabulation for the maximum average atmospheric concentration of contaminants to which workers may be exposed for an 8-hour working day without injury to health.

These values are based on the best available information from industrial experience, from experimental studies, and, when possible, from a combination of the two. They are not fixed values but are reviewed annually by the Committee on Threshold Limits of the American

Conference of Governmental Industrial Hygienists for changes, revisions, or additions as further information becomes available. Threshold limits should be used as guides in the control of health hazards and should not be regarded as fine lines between safe and dangerous concentrations. They represent conditions only within which it is felt that workers may be repeatedly exposed, day after day, without their health being adversely affected. It is felt, at the present time, that workers should not be exposed to a working environment containing any of these substances in excess of the value indicated.

These values are not intended for use, or for modification for use, in the evaluation or control of community air pollution or air pollution nuisances.

*Members of the Committee on Threshold Limits of the American Conference of Governmental Industrial Hygienists are: Allan L. Coleman, chairman, William L. Ball, L. T. Fairhall, Kingsley Kay, H. E. Stokinger, A. J. Vorwald, and Louis F. Weller.*

### ESTABLISHED VALUES

#### Gases and Vapors

SUBSTANCE	P.P.M.
Acetaldehyde	200
Acetic acid	10
Acetic anhydride	5
Acetone	1,000
Acrolein	0.5
Acrylonitrile	20
Ammonia	100
Amyl acetate	200
Amyl alcohol (isoamyl alcohol)	100
Aniline	5
Arsine	0.05
Benzene (benzol)	35
Bromine	1
Butadiene (1,3-butadiene)	1,000
Butanone (methyl ethyl ketone)	250
Butyl acetate (n-butyl acetate)	200
Butyl alcohol (n-butanol)	100
Butyl cellosolve (2-butoxyethanol)	200
Carbon dioxide	5,000
Carbon disulfide	20
Carbon monoxide	100

SUBSTANCE	P.P.M.
Carbon tetrachloride	25
Cellosolve (2-ethoxyethanol)	200
Cellosolve acetate (hydroxyethyl acetate)	100
Chlorine	1
Chlorobenzene (monochlorobenzene)	75
Chloroform (trichloromethane)	100
1-Chloro-1-nitropropane	20
Chloroprene (2-chlorobutadiene)	25
Cresol (all isomers)	5
Cyclohexane	400
Cyclohexanol	100
Cyclohexanone	100
Cyclohexene	400
Cyclopropane	400
o-Dichlorobenzene	50
Dichlorodifluoromethane	1,000
1,1-Dichloroethane	100
1,2-Dichloroethylene	200
Dichloroethyl ether	15
Dichloromonofluoromethane	1,000
1,1-Dichloro-1-nitroethane	10
Dichlorotetrafluoroethane	1,000
Diethylamine	25
Dimethylaniline (N-dimethylaniline)	5
Dimethylsulfate	1
Dioxane (diethylene dioxide)	100

P.P.M.=parts of vapor or gas per million parts of air, by volume.

there are millions of individuals in the United States today, possibly 50 million, who are infected with tubercle bacilli. It is necessary, however, to learn more about the changes which are occurring in new tuberculous infections in the many social, biological, and geographic segments of our population.

### Looking Forward

It is hazardous to risk predictions of trends in any field, particularly in tuberculosis. Yet the future is a lure difficult to resist. So marked has been the decline in the death rate of tuberculosis in the past 10 years that to many its disappearance as a public health problem seems an eventuality of an immediate tomorrow. Such optimism is a trap into which even the most guarded minds have fallen, and from them frequently comes the question, "How much longer shall we continue to exert tuberculosis control efforts?"

Despite the unreality of setting an end point for tuberculosis as a public health challenge, an intermediate goal can arbitrarily be selected for the sake of argument, and time limits can be drawn to emphasize the continuing magnitude of the problem.

Even in terms of death rates alone the future

task is large and prolonged. It will require years of effort to achieve a death rate of only 1.5 per 100,000 population, which is about the current death rate from acute rheumatic fever, appendicitis, arthritis, poliomyelitis, and several other diseases which are still considered to be of public health import. The maternal mortality rate is about at that level. Measles, whooping cough, and infectious hepatitis combined do not exceed it. When the death rate from tuberculosis drops to the level of these important diseases, then tuberculosis control programs and needs should be reexamined.

Indeed, if conditions remain the same, and if control activities are so maintained that the rate of decline in mortality will equal that of the past 5 years:

It will be 11 years before the crude tuberculosis death rate is 1.5 per 100,000 population; 7 years before this death rate is achieved for white females; between 10 and 15 years, for non-white males and females, and white males; and 25 years before the age group over 65 has a death rate of 1.5 per 100,000 population.

The task of defeating tuberculosis is plainly not done. Persisting cases of tuberculosis, especially those out of hospitals, challenge every ingenuity in planning the content and scope of control programs of tomorrow.

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## Armed Services Medical and Dental Symposium

A 3-day symposium, sponsored by the First Naval District, Boston, Mass., on developments in military medicine and dentistry with special emphasis on atomic warfare, special weapons, and isotopes has been scheduled for March 21-23, 1956.

The first meeting will be held at the United States Naval Hospital, Chelsea, Mass. On the mornings of the second and third days, clinics will be scheduled at various hospitals in Boston on the treatment of disease with radioactive isotopes. Afternoon lectures will be given at the Jimmy Fund Foundation Building and at the New England Deaconess Hospital.

Programs and additional information may be obtained from the District Medical Officer, First Naval District, 495 Summer Street, Boston 10, Mass.

# TENTATIVE THRESHOLD LIMIT VALUES

The following values are suggested for further consideration before being presented for adoption as established values. (An asterisk \* marks materials added in 1955 and for which bibliographical material has been prepared. The other materials appeared in the 1954 report.) It is proposed that the entire list will be presented for adoption at the meeting of the American Conference of Governmental Indus-

trial Hygienists in 1956, if no reason to the contrary is forthcoming.

Reference material has been prepared on each of the following substances and, though in some instances it is rather meager, it is available for distribution. The committee welcomes suggestions of substances to be added and also comments, additional references, or reports of experience with these materials.

Aldrin (1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-dimethanonaphthalene)-----	0.25	mg/M <sup>3</sup>
Allyl alcohol-----	5	p.p.m.
Allyl propyl disulfide-----	2	p.p.m.
Ammate (ammonium amidosulfate)-----	15	mg/M <sup>3</sup>
Benzyl chloride-----	1	p.p.m.
Butyl amine*-----	5	p.p.m.
Butyl mercaptan-----	10	p.p.m.
Calcium arsenate-----	0.3	mg/M <sup>3</sup>
Chlordane (1,2,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanoindane)-----	2.0	mg/M <sup>3</sup>
Chlorine trifluoride*-----	0.1	p.p.m.
Chlorinated diphenyl oxide*-----	0.5	mg/M <sup>3</sup>
Crag Herbicide (sodium-2,4-dichlorophenoxy ethyl sulfate)-----	15	mg/M <sup>3</sup>
2,4-D (2,4-dichlorophenoxyacetic acid)-----	10	mg/M <sup>3</sup>
D. D. T. (2,2-bis-(p-chlorophenyl)-1,1,1-trichloroethane)-----	2.0	mg/M <sup>3</sup>
Diacetone alcohol (4-hydroxy-4-methyl pentanone-2)-----	50	p.p.m.
Diborane*-----	0.1	p.p.m.
Dieldrin (1,2,3,4,10,10-hexachloro-6,7, epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-dimethanonaphthalene)-----	0.25	mg/M <sup>3</sup>
Difluorodibromomethane*-----	100	p.p.m.
Diisobutyl ketone-----	50	p.p.m.
EPN (ethyl-p-nitrophenyl thiono benzene phosphonate)-----	0.5	mg/M <sup>3</sup>
Ethyl mercaptan-----	250	p.p.m.
Ethylene diamine*-----	10	p.p.m.
Ethylene imine*-----	5	p.p.m.
Ferro vanadium dust-----	1	mg/M <sup>3</sup>
Furfural-----	5	p.p.m.
Furfuryl alcohol*-----	200	p.p.m.
Hydrazine*-----	1	p.p.m.
Hydrogen bromide*-----	5	p.p.m.
Hydrogen peroxide, 90 percent*-----	1	p.p.m.

Hydroquinone*-----	2	mg/M <sup>3</sup>
Isopropylamine*-----	5	p.p.m.
Lead arsenate-----	0.2	mg/M <sup>3</sup>
Lindane (hexachlorocyclohexane, gamma isomer)-----	0.5	mg/M <sup>3</sup>
Malathion (0,0-dimethyl dithio phosphate of diethyl mereaptosuccinate)-----	15	mg/M <sup>3</sup>
Methoxychlor (2,2-diparamethoxyphenyl-1,1,1-trichloroethane)-----	15	mg/M <sup>3</sup>
Methyl acetylene*-----	1,000	p.p.m.
Methyl isobutyl carbinol (methyl amyl alcohol)-----	25	p.p.m.
Methyl mercaptan-----	50	p.p.m.
Molybdenum (soluble compounds)*-----	5	mg/M <sup>3</sup>
(insoluble compounds)*-----	15	mg/M <sup>3</sup>
p-Nitroaniline-----	1	p.p.m.
Organo mercurials (as mercury)-----	0.01	mg/M <sup>3</sup>
Perchloromethyl mercaptan-----	0.1	p.p.m.
Phenyldiazine-----	5	p.p.m.
Pieric acid-----	0.1	mg/M <sup>3</sup>
Propylene imine*-----	25	p.p.m.
Pyridine-----	10	p.p.m.
Quinone*-----	0.1	p.p.m.
Sodium hydroxide-----	2	mg/M <sup>3</sup>
Sulfur hexafluoride-----	1,000	p.p.m.
Sulfur pentafluoride-----	0.025	p.p.m.
TEDP (tetraethyl dithiono pyrophosphate)-----	0.2	mg/M <sup>3</sup>
TEPP (tetraethyl pyrophosphate)-----	0.05	mg/M <sup>3</sup>
p-Tertiary butyl toluene*-----	10	p.p.m.
Tetrahydrofuran*-----	75	p.p.m.
Tetranitromethane*-----	1	p.p.m.
Titanium dioxide-----	15	mg/M <sup>3</sup>
Trifluoromonobromomethane*-----	1,000	p.p.m.
Vanadium (V <sub>2</sub> O <sub>5</sub> dust)-----	0.5	mg/M <sup>3</sup>
(V <sub>2</sub> O <sub>5</sub> fume)-----	0.1	mg/M <sup>3</sup>
Zirconium-----	5	mg/M <sup>3</sup>

**BERYLLIUM:** During the past few years, several papers have reported a limit of 2γ per cubic meter of air for beryllium. Among these is the paper by Van Ordstrand, H. S.: Berylliosis, A. M. A. Arch. Indust. Hyg. 10: 232-234, September 1954, and one by Sterner, J. H., and Eisenbud, M.: Epidemiology of Beryllium

Intoxication, A. M. A. Arch. Indust. Hyg. 4: 123-151, August 1951. Conflicting data from industrial experience have caused the committee to postpone the suggestion of a threshold limit for this material. It is apparent that more epidemiological work is needed for the establishment of a definite view.



SUBSTANCE	P.P.M.
Ethyl acetate	400
Ethyl alcohol (ethanol)	1,000
Ethylamine	25
Ethyl benzene	200
Ethyl bromide	200
Ethyl chloride	1,000
Ethyl ether	400
Ethyl formate	100
Ethyl silicate	100
Ethylene chlorohydrin	5
Ethylene dibromide (1,2-dibromoethane)	25
Ethylene dichloride (1,2-dichloroethane)	100
Ethylene oxide	100
Fluorine	0.1
Fluorotrichloromethane	1,000
Formaldehyde	5
Gasoline	500
Heptane (n-heptane)	500
Hexane (n-hexane)	500
Hexanone (methyl butyl ketone)	100
Hexone (methyl isobutyl ketone)	100
Hydrogen chloride	5
Hydrogen cyanide	10
Hydrogen fluoride	3
Hydrogen selenide	0.05
Hydrogen sulfide	20
Iodine	1
Isophorone	25
Mesityl oxide	50
Methyl acetate	200
Methyl alcohol (methanol)	200
Methyl bromide	20
Methyl cellosolve (methoxyethanol)	25
Methyl cellosolve acetate (ethylene glycol monomethyl ether acetate)	25
Methyl chloride	100
Methylal (dimethoxymethane)	1,000
Methyl chloroform (1,1,1-trichloroethane)	500
Methyleyclohexane	500
Methyleyclohexanol	100
Methyleyclohexanone	100
Methyl formate	100
Methylene chloride (dichloromethane)	500
Naphtha (coal tar)	200
Naphtha (petroleum)	500
Nickel carbonyl	0.001
Nitrobenzene	1
Nitroethane	100
Nitrogen dioxide	5
Nitroglycerin	0.5
Nitromethane	100
2-Nitropropane	50
Nitrotoluene	5
Octane	500
Ozone	0.1
Pentane	1,000
Pentanone (methyl propyl ketone)	200
Perchloroethylene (tetrachloroethylene)	200
Phenol	5
Phosgene (carbonyl chloride)	1
Phosphine	0.05
Phosphorus trichloride	0.5
Propyl acetate	200
Propyl alcohol (isopropyl alcohol)	400
Propyl ether (isopropyl ether)	500
Propylene dichloride (1,2-dichloropropane)	75
Stibine	0.1
Stoddard solvent	500
Styrene monomer (phenyl ethylene)	200
Sulfur monochloride	1
Sulfur dioxide	10
1,1,2,2-Tetrachloroethane	5
Toluene	200
o-Toluidine	5

SUBSTANCE	P.P.M.
Trichloroethylene	200
Turpentine	100
Vinyl chloride (chloroethene)	500
Xylene	200

### Toxic Dusts, Fumes, and Mists

SUBSTANCE	MG. PER CU. M.
Antimony	0.5
Arsenic	0.5
Barium (soluble compounds)	0.5
Cadmium	0.1
Chlorodiphenyl	1
Chromic acid and chromates as CrO <sub>3</sub>	0.1
Cyanide as CN	5
Dinitrotoluene	1.5
Dinitro-o-cresol	0.2
Fluoride	2.5
Iron oxide fume	15
Lead	0.15
Magnesium oxide fume	15
Manganese	6
Mercury	0.1
Parathion (O,O-Diethyl-O-p-allylphenyl thio-phosphate)	0.1
Pentachloroaphthalene	0.5
Pentachlorophenol	0.5
Phosphorus (yellow)	0.1
Phosphorus pentachloride	1
Phosphorus pentasulfide	1
Selenium compounds (as Se)	0.1
Sulfuric acid	1
Tellurium	0.1
Tetryl (2,4,6-trinitrophenyl-methylnitramine)	1.5
Trichloroaphthalene	5
Trinitrotoluene	1.5
Uranium (soluble compounds)	0.03
Uranium (insoluble compounds)	0.25
Zinc oxide fumes	15

**RADIOACTIVITY:** For permissible concentrations of radionuclides in air see Maximum Permissible Amounts of Radionuclides in the Human Body and Maximum Permissible Concentrations in Air and Water, handbook 52, U. S. Department of Commerce, National Bureau of Standards, March 1953. In addition, see Permissible Dose from External Sources of Ionizing Radiation, handbook 59, Department of Commerce, National Bureau of Standards, September 24, 1954.

MG. PER CU. M.=milligrams of dust, fume, or mist per cubic meter of air.

### Mineral Dusts

SUBSTANCE	M.P.P.C.F.
Aluminum (aluminum oxide)	50
Asbestos	5
Carborundum (silicon carbide)	50
Dust (nuisance, no free silica)	50
Mica (below 5 percent free silica)	20
Portland cement	50
Talc	20
Silica:	
High (above 50 percent free SiO <sub>2</sub> )	5
Medium (5 to 50 percent free SiO <sub>2</sub> )	20
Low (below 5 percent free SiO <sub>2</sub> )	50
Slate (below 5 percent free SiO <sub>2</sub> )	50
Soapstone (below 5 percent free SiO <sub>2</sub> )	20
Total dust (below 5 percent free SiO <sub>2</sub> )	50

M.P.P.C.F.=Millions of particles per cubic foot of air.

special inventory form, which the Public Health Service made available to State health departments in 1950. The form, prepared with the assistance of the American Public Works Association and various individuals, had been designed to facilitate uniform collection of refuse-handling data. The rest of the data were secured from published reports of other surveys conducted during the inventory period by State health departments or other agencies concerned with refuse handling.

The data presented in this report must be interpreted with cognizance of two limitations. First, although data were received from 30 States, 98 percent of the cities surveyed were in 17 States located east of the Rocky Mountains. Second, certain of the communities reported on early in the inventory period undoubtedly had changed their practices by 1954. Nevertheless, the information presented may provide assistance in evaluating refuse-sanitation practices in the United States.

The data collected during the course of the inventory show encouraging trends, but they also indicate that, despite the long-standing problem of disposing of municipal solid wastes, the preponderance of the job still remains to be accomplished.

### Regulations

Three hundred forty-two cities reported that they had regulations governing one or more of the three phases of refuse handling, namely, storage, collection, or disposal. However, because of the nature of the data on the remaining 931 cities, it was not possible to establish what percentage of the latter actually did not have regulations on refuse handling.

Of the 342 cities, 53 percent had regulations which governed all 3 phases. Twenty-two percent had regulations governing storage only, and another 10 percent had regulations covering storage and either collection or disposal. The remaining 15 percent had regulations controlling collection only, disposal only, or both of these.

Data on the enforcement of regulations were received from 260 cities. Fifty-three (20 percent) of these reported that the regulations were enforced by the police department; 34

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## Definition of Terms

**Refuse:** All putrescible and nonputrescible solid wastes (except body wastes), including garbage, rubbish, ashes, street cleanings, dead animals, abandoned automobiles, and solid market and industrial wastes.

**Garbage:** Putrescible animal and vegetable wastes resulting from the handling, preparation, cooking, and consumption of food.

**Ashes:** The residue from the burning of wood, coal, coke, or other combustible materials.

**Rubbish:** Nonputrescible solid wastes (except ashes), consisting of both combustible and noncombustible wastes, such as paper, cardboard, cans, grass and shrubbery clippings, wood, glass, bedding, and crockery.

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(13 percent), by the public works department or the agency responsible for the collection of refuse; 40 (15 percent), by the health department; and 72 (28 percent) reported that enforcement was the joint responsibility of the health department and some other municipal department, such as the police or public works department. (The remaining 61 cities did not specify the enforcement agency.)

### Storage Practice

*Separation requirements.* Data on separation requirements were received for 1,244 cities. In 488 (39 percent) complete separation of garbage, rubbish, and ashes was required. Combined storage of all refuse was permitted by 642 (52 percent), and 98 (8 percent) required only the separation of garbage from other refuse. Other requirements, such as separation of combustibles from noncombustibles, were reported by 16 cities (1 percent).

*Types of containers.* Data concerning the use of covered metal containers for storing refuse are given in table 1. It is encouraging to note that for garbage or refuse containing garbage about 85 percent of the reporting cities required the use of this type of container.

*Size of containers.* Of the 95 cities reporting on the size of containers used for storing resi-

*A summary report on refuse storage, collection, and disposal practices in 1,273 cities in 30 States, 1951-54.*

# Refuse Handling Practices in the United States

By MALCOLM C. HOPE, M.S., M.P.H., CHARLES C. JOHNSON, Jr., B.S.  
and LEO WEAVER, B.C.E.

THE sanitary storage, collection, and disposal of municipal refuse have been a community problem, in varying degrees, since men first banded together for protection. It is only in recent years, however, that the problem has begun to receive concerted attention and action.

Studies have shown that the sanitary handling of refuse is an important factor in controlling such disease vectors as rats, flies, and mosquitoes. The feeding of raw garbage to hogs has been shown to be not only an important factor in the chain of transmission of trichinosis to man, but also a primary mode of transmission of virus diseases of swine, such as vesicular ex-

anthema. In certain metropolitan areas, disposal of refuse by burning in backyard or apartment-house incinerators has been singled out as a significant source of air pollution. The National Fire Protection Association has reported data indicating that in 1953 "rubbish, ignition unknown" ranked third among 26 known causes of fires in buildings. Furthermore, the public is becoming impatient with the nuisances and inconveniences fostered by inadequate and insanitary refuse-handling systems.

So that the extent of the refuse-handling problem might be better understood and the job which yet needs to be done planned accordingly, the Public Health Service has made an inventory of municipal refuse storage, collection, and disposal practices. During the period 1951 through 1954, data outlining practices of 1,273 cities in 30 States were obtained. These data are summarized in this report. Distribution of the cities according to population group is shown in the following tabulation:

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*Mr. Hope is chief of the General Engineering Program, Division of Sanitary Engineering Services, Public Health Service. Mr. Johnson and Mr. Weaver are staff engineers in that program.*

*The inventory reported in this paper was initiated and carried on under the supervision of Ralph J. Van Derwerker and Eugene L. Lehr when they were with the Division of Sanitary Engineering Services. Mr. Van Derwerker is chief sanitary engineer officer of the United States Coast Guard, and Mr. Lehr is assistant chief, Sanitation Services Branch, Division of Indian Health, Public Health Service.*

*William Xanten, superintendent of sanitation of Washington, D. C., and William Foster, engineering editor of the American City Magazine, among others, assisted in preparing the inventory form.*

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Population group	Number of cities
1,000-4,999	765
5,000-9,999	237
10,000-24,999	160
25,000-49,999	55
50,000-99,999	23
100,000 or more	30
Unknown	3

Most of the data included in this inventory were collected by or through State health departments. These data were reported on a

**Table 3. Frequency of refuse collection in residential areas**

Class of refuse	Summer collection					Winter collection				
	Number of cities reporting	Less than 1 per week	1 per week	2 per week	More than 2 per week	Number of cities reporting	Less than 1 per week	1 per week	2 per week	More than 2 per week
Garbage.....	284	2	85	151	46	281	3	137	107	34
Rubbish.....	99	14	35	38	12	98	14	46	30	8
Ashes.....						19	4	8	5	2
Combined refuse.....	414	42	172	157	43	410	42	202	127	39

**Table 4. Frequency of refuse collection in commercial areas**

Class of refuse	Summer collection					Winter collection				
	Number of cities reporting	Less than 1 per week	1 per week	2 or more per week but less than daily	Daily	Number of cities reporting	Less than 1 per week	1 per week	2 or more per week but less than daily	Daily
Garbage.....	239	2	29	90	118	236	2	53	68	113
Rubbish.....	94	10	9	24	51	93	10	11	24	48
Ashes.....						16	3	4	3	6
Combined refuse.....	387	27	60	93	207	387	26	71	85	201

*Types of vehicles.* Data on the types of vehicles used in collecting refuse were received from 337 cities having municipal collection. Of these, 157 (46 percent) relied on open vehicles for the collection of refuse. About 10 percent reported the use of covered vehicles, and another 10 percent, mechanical-compactor-type vehicles. The remaining 34 percent reported the use of combinations of these types of vehicles.

Data from 82 cities using contract collection showed that 49 (60 percent) used open vehicles. Only 12 (15 percent) reported the use of the mechanical-compactor type either exclusively or in combination with other types. Data from 147 cities having private collection arrange-

ments revealed that 111 (75 percent) relied on open vehicles. Only 11 (10 percent) reported the use of the mechanical-compactor type either exclusively or in combination with other types.

*Method of financing.* Table 7 lists the data reported on the method of financing refuse collections. Of the 633 cities that specified their method of financing, 382 (60 percent) indicated that they relied solely on the fee system. An additional 50 (8 percent) reported the use of both special fees and the general tax fund. An analysis of the data by population group revealed that of the communities in the 1,000-4,999 category 75 percent relied wholly or in part on the fee system; of those in the 5,000-9,999 category, 62 percent; of those in the 10,000-24,999 group, 63 percent; of those in the 25,000-49,999 category, 48 percent; of those in the 50,000-99,999 category, 34 percent; and of the cities with 100,000 or more population, 39 percent.

*Miscellaneous data.* Of 561 cities providing information on the private collection of garbage for hog feed, 464 (83 percent) specified that they permitted this practice. However, during the period of this inventory, many communities

**Table 5. Designated point of refuse collection in 448 cities**

Point of collection	Number	Percent
Curb or alley, or both.....	190	43
Front houseline.....	10	2
Rear houseline.....	33	7
Combination of above points.....	201	45
Other.....	14	3

**Table 1. Percentage of reporting cities requiring covered metal storage containers**

Class of refuse	Residential		Commercial	
	Number cities re- porting	Percent requiring covered metal con- tainers	Number of cities re- porting	Percent requiring covered metal con- tainers
Garbage-----	138	83	119	81
Rubbish-----	26	58	14	50
Ashes-----	8	25	6	33
Combined re- fuse-----	171	87	131	86

dential garbage, only 12 (13 percent) permitted storage in containers larger than 30 gallons. Where combined storage of refuse was practiced, however, 43 (36 percent) of the 118 reporting cities permitted containers larger than 30 gallons. Table 2 shows the residential container-size requirements reported for each class of refuse.

Data on the size of containers used for commercial garbage from 69 cities showed that 28 (41 percent) required that containers be of 30 gallons or less. Thirty-two (46 percent) allowed the use of containers up to 40 gallons in size, and 9 (13 percent) permitted storage in containers larger than 40 gallons. Where combined storage of refuse was permitted, 57 of 98 cities required that containers be of 30 gallons or less, the remainder permitting the use of containers larger than 30 gallons in capacity.

### Collection Practice

*Frequency of collection.* Tables 3 and 4 show the variations in the frequency of collection for the various classes of refuse according to season of the year. Of the 698 cities reporting on the summer collection of garbage or combined refuse in residential areas, 397 (57 percent) made collections at least twice a week. With respect to summer collection from commercial establishments, 352 (52 percent) of 626 cities reported that garbage or refuse containing garbage was collected daily. An additional 138 (29 percent) collected this material at least twice a week.

As might be presumed, during the winter

fewer cities provided twice-a-week collection. However, 646 (93 percent) of the 691 cities reporting on winter collection of garbage or combined refuse in residential areas provided at least once-a-week pickup of this material.

*Point of collection.* Information was obtained from 448 cities on the point at which the collection crew was authorized to pick up refuse. As shown in table 5, 190 (43 percent) specified either the curb or the alley, or both, as the pickup point. Two hundred one (45 percent) reported various combinations of curb, alley, front houseline, and rear houseline as being acceptable pickup points.

*Responsibility for collection.* In table 6 are the data concerning the agencies responsible for the collection of municipal refuse. It is interesting to note that, when each class of refuse is considered separately, there is a similarity between commercial and residential responsibilities. The responsibility for collection of garbage is fairly evenly distributed on a municipal, contract, and private basis.

Combined collection of refuse in more than 50 percent of the communities was accomplished by private or individual arrangements. Analysis of the data showed that 373 of the 393 cities (95 percent) reporting private residential collection were in the 1,000-9,999 population group. On the other hand, only 20 of 112 cities (18 percent) having a population of 10,000 or more utilized private collection, and 79 (68 percent) utilized municipal collection. A similar relationship between population and responsibility for collection was found upon analysis of the data on combined collection of refuse in commercial areas.

**Table 2. Size of containers for residential refuse**

Class of refuse	Number of cities reporting	Number reporting maximum size of—			Number allowing more than 30 gallons
		Less than 10 gallons	10-19 gallons	20-30 gallons	
Garbage-----	95	6	20	57	12
Rubbish-----	22	0	2	10	10
Ashes-----	9	1	2	4	2
Combined refuse-----	118	0	13	62	43

*Several agencies interested in rural development pool their experience to accelerate a program to install water systems for Tennessee Valley farmers.*

## Combined Efforts Stimulate Development of Rural Water Systems

By C. H. WEAVER, B.S., C. T. ROBERTS, and C. M. DAVIDSON, C.E., M.P.H.

FARM WATER supplies under pressure are practically nonexistent in many localities in the southeastern United States. In the Tennessee Valley, an estimated 25 percent of rural families had such water supplies in 1953.

Since that time an accelerated rural water system program has been developed in the Tennessee Valley, based on cooperation among the various agencies concerned with the health and welfare of rural people.

Cooperating have been State and county health departments, county and home demonstration agents, vocational agriculture groups, local power systems which retail electricity, and the Tennessee Valley Authority, a Federal agency with interests in many phases of regional development.

These agencies have combined their efforts in order to (a) improve rural sanitation and health; (b) encourage more farm people to have a safe, dependable water supply; and (c) im-

prove rural living generally through the many improvements that running water under pressure makes possible.

The present cooperative program is based on ideas developed by the Mississippi State Board of Health through an experience in Winston County, Miss., and by the TVA in the Chestnut watershed area of eastern Tennessee.

### The Chestnut Experience

A low percentage of the 854 farms in the Chestnut area had pressure water systems when a program to inform the farm people about the advantages of safe and dependable water supplies was initiated. TVA agricultural and sanitary engineers, working with county agents in three counties and with health department sanitarians, called on farmers to discuss water supply, taking along demonstration electric pump equipment.

Then the county sanitarians and TVA agricultural engineers held four rural community water systems demonstrations on farms where water systems were actually being installed. Sanitarians planned the well location and the waste disposal system. Agricultural engineers assisted with technical data on pump size and other factors. Together they showed the farmers how to install a pressure water system which would assure an adequate safe supply of water.

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**Table 6. Responsibility for collection of refuse**

Class of refuse	Number of cities reporting	Municipal (percent)	Municipal contract (percent)	Private (percent)
Garbage:				
Residential.....	574	32	38	30
Commercial.....	569	30	38	32
Rubbish or ashes:				
Residential.....	138	61	17	19
Commercial.....	136	58	17	25
Combined refuse:				
Residential.....	740	37	10	53
Commercial.....	740	35	9	56

**Table 7. Method of financing refuse collection, according to population group**

Population group	Fees	General taxes	Both fees and taxes	Method not specified
1,000-4,999.....	282	103	21	359
5,000-9,999.....	52	40	11	134
10,000-24,999.....	33	25	9	93
25,000-49,999.....	9	13	3	30
50,000-99,999.....	2	8	2	11
100,000 or more.....	1	11	3	12
Total.....	382	201	50	610

undoubtedly experienced considerable change in the methods by which agencies or individuals arranged to handle garbage ordinarily fed to swine. In 1952, the feeding of raw garbage to swine was shown to be a primary cause of the widespread outbreak of the virus disease of swine, vesicular exanthema, which occurred in that year. By 1955, all but two States had regulations requiring the disinfection of garbage fed to swine. The United States Department of Agriculture reported that as of June 30, 1955, 83 percent of almost 1½ million garbage-fed swine on more than 13,000 garbage-feeding establishments were fed cooked garbage.

With regard to the installation of garbage grinders, 28 of 503 reporting cities (6 percent)

prohibited the installation of these devices. Of interest was the fact that 21 of the 28 cities were in the 1,000-9,999 population category.

Of 688 cities reporting on scavenging practice (during the storage or collection period), 139 (20 percent) reported that scavenging was not permitted. Of the cities reporting that scavenging was permitted, almost 90 percent indicated that no license was required.

### Disposal Practice

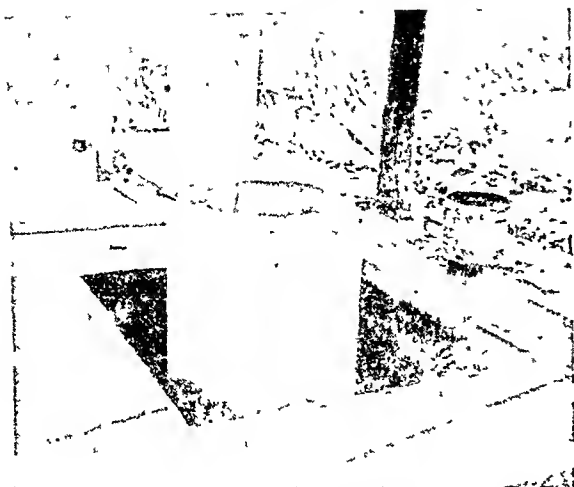
All 1,149 cities reporting on disposal practice indicated the use of one or more of four methods of disposal: incineration, sanitary land fill, open dump, and hog feeding. Ninety-one of the cities (8 percent) reported the use of incineration and 114 (almost 10 percent) reported the use of the sanitary land fill. Table 8 gives the number of cities, according to population category, using each of the four methods.

**Table 8. Number of cities reporting use of specified methods of refuse disposal, according to population group**

Population group	Number of cities reporting	Incineration	Sanitary land fill	Open dump	Hog feeding
1,000-4,999.....	667	18	32	539	159
5,000-9,999.....	221	26	24	131	80
10,000-24,999.....	156	18	19	76	73
25,000-49,999.....	53	12	16	25	21
50,000-99,999.....	20	6	11	7	8
100,000 and over.....	29	11	11	16	7
Total.....	1,149	91	114	796	348

<sup>1</sup> Population group not specified for 3 cities. <sup>2</sup> Population group not specified for 1 city. <sup>3</sup> Population group not specified for 2 cities.

Of significance was the fact that 616 (54 percent) of the 1,149 cities reported the use of the open dump as their only means of disposal. Another 130 (11 percent) reported the use of a combination of the open dump and hog feeding as their only means of refuse disposal.



**Concrete is utilized in Monroe County, Miss., to protect well from surface water contamination.**

If a spring is used, is it protected from surface drainage?

4. Do you own your farm? If not, whose farm do you live on?

5. Would you like someone who could give you information on these items of sanitation to visit your home?

Such a postcard questionnaire was sent out by seven power associations in northeastern Mississippi.

Of the 24,568 farm families which received these cards, 9,103, or about 37 percent, have thus far returned them. Of the families returning the cards, nearly half (4,254) have requested a visit from the health department and the power association. Home visits made total 3,480. Of these 1 out of 5 have installed pressure water systems, and 22 percent have protected their water supplies by sealing and concreting.

Now the idea has spread to rural electric systems in northern Alabama, where 2 surveys have been started, and in Tennessee, where 6 surveys are in process. These 8 surveys will reach 50,000 farm families.

To encourage rural people to return the survey cards, local pump dealers and other businessmen offered prizes. A drawing was held from the returned survey cards, this drawing often being made at a public gathering where representatives of the health department and the power association made brief talks on pressure water systems and rural sanitation. The

survey cards, in addition to giving valuable information about water supply and sanitation conditions, have presented the health department and the power associations with an invitation to visit thousands of farm homes to discuss sanitation.

Calls are made first on those persons who actually indicate on the survey card that they want a visit. Next, other persons surveyed are contacted. The general pattern has been that the county sanitarian and the power association's agricultural engineer have made the first few farm visits together. Then they have divided the remaining calls. The sanitarian is especially qualified to give advice and answer questions about rural sanitation; the agricultural engineer is trained to handle inquiries about the selection and installation of pressure water systems. But in working together each of these specialists learns much about the other's work.

### **Water System Workshops**

After the surveys were under way, it was decided that a series of water system workshops in various parts of northeastern Mississippi would be held to give detailed information on pressure water systems and sanitation to field workers from the several interested agencies. This was essentially a matter of "teaching the teachers," since those invited included county sanitarians, other local and State health officials, vocational agriculture teachers, teachers of veterans' classes, extension service workers, county agents, and power association personnel.

Those making talks included agricultural engineers from power associations and TVA, representatives of the health departments, the extension service, and the agricultural education department.

In addition to lectures, there were demonstrations to teach the agricultural and health workers as much as possible about running water on the farm. At each meeting there were trailers equipped with different types of electric pumps. The pumps had moving parts exposed so their operation could be easily explained. Other equipment included a telescoping tower which was used to demonstrate the effect of elevation on pump efficiency. By raising a pump



Later, a 1954 survey showed that 250 farms, 30 percent of the total, had pressure water systems. Another 143 farm families said they wanted such systems soon. From the Chestnee experience, these two ideas were gained:

1. Cooperation among several groups interested in rural water supply, particularly health departments and local power systems, is the key to effective work in this field.

2. Personal calls on farmers are particularly successful in encouraging utilization of safe, adequate water supplies.

### Winston County Experience

In the spring of 1954, the sanitarian of Winston County, Miss., with the aid of the Mississippi State Board of Health, conducted a rural sanitation survey in his county. The survey was aimed at obtaining general information about water supply, excreta disposal, and screening of doors and windows. The sanitarian used the Agricultural Stabilization Committee's mailing list and received 600 replies from 2,300 survey sheets sent out.

One of the questions asked was, "Do you wish the sanitation supervisor to visit your place to help you with your problems?" Three hundred seventy-five answered in the affirmative, and 380 visits were made. As a result, 112 wells were protected, 62 new pressure water systems were installed, and 102 septic tanks were installed or improved.

The Winston County survey was a success, but it proved to be too expensive for a county health department since no funds are budgeted for this type of survey in Mississippi county health departments. Too, the Agricultural Stabilization Committee's mailing list proved to be out of date.

### Collective Effort in Mississippi

Early in 1954, the Mississippi State Board of Health and local health departments were developing plans for a more intensive approach to rural sanitation problems in Mississippi.

TVA's Electrical Development Branch, which works with local distributors of TVA-generated electricity, is interested in improving farm living through the improved use of elec-

tricity. TVA's Division of Health and Safety has a variety of interests directed toward the problem of rural sanitation. The rural electric power associations in northeastern Mississippi want to encourage more widespread use of pressure water systems, which in turn lead to the benefits of electric water heating, automatic home laundries, and other electrical conveniences. Other groups, including vocational agriculture teachers, extension service representatives, and the colleges and universities, are concerned with improved farm living, increased farm production, and farm sanitation. Pump dealers are natural allies in this field.

These groups joined in a program to improve rural sanitation and to encourage more use of electrically powered pressure water systems on farms. The program was built around the ideas developed in Winston County, Miss., and in the Chestnee area of eastern Tennessee, namely, (a) cooperation among all interested agencies, (b) personal calls and home visits to farmers, (c) the questionnaire survey, and (d) group demonstrations. Two main activities were included:

1. A postcard survey of rural people was conducted, followed by personal calls at the farms of those persons who requested such visits from the health department and the rural power association.

2. A series of 1-day workshops on pressure water systems and sanitation was carried out. The workshops were a cooperative effort of the county health departments, the Mississippi State Board of Health, local power associations, the vocational agriculture department of the State department of education, the extension service, and TVA.

### The Survey

County sanitarians and local power associations worked out a postcard questionnaire with these questions:

1. Is your water supply from a dug, bored, driven, or drilled well or from a spring or cistern?

2. Do you get water from its source by a pitcher, handforce, or electric pump or by rope and bucket?

3. Is your well protected by a concrete slab?

18 percent. As a matter of fact, there were 59 percent more individual protected water supplies installed in just one of the completely surveyed counties than in all of the 13 non-surveyed counties combined.

These figures indicate clearly that concentrated efforts on improved sanitation and increased use of pressure water systems will show definite results when the talents of several co-operating groups are focused on this problem.

The spread of this approach to other areas was inevitable. Already several power systems in Tennessee and Alabama are working with

local health officials and other groups on such a program. The Communicable Disease Center, Public Health Service, made a special request to have the water systems workshops program presented at two 1-day sessions near Atlanta, Ga. These workshops were enthusiastically received by those present.

More definite results will be available at a later date. Thus far, however, it seems certain that the program in northeastern Mississippi has done more to stir up interest in improved rural sanitation than any other approach to the problem.

## 1955 Water Supply Inventory

More than 52 million people in communities of 25,000 and over now depend on surface sources for their daily water supplies as compared with fewer than 40 million in 1948. The 1955 inventory of the Nation's water supplies also revealed that less than 1 percent of the

population in such communities use untreated water.

The inventory was compiled by the Public Health Service Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, from data provided by State and local health departments.

### Water supply inventories, 1948 and 1955

Item	1948	1955
Number of communities with population of 25,000 and over with public water supply...	422	570
Census population of these communities....	<sup>1</sup> 53, 212, 143	<sup>2</sup> 63, 954, 905
Population served by these communities....	61, 864, 210	82, 647, 716
<i>Ownership</i>		
Public:		
Number.....	335	435
Percent.....	79. 4	76. 3
Private:		
Number.....	58	98
Percent.....	16. 1	17. 2
Public and private:		
Number.....	13	2
Percent.....	3. 1	. 4
Unreported:		
Number.....	6	35
Percent.....	1. 4	6. 1
<i>Supply source</i>		
Ground:		
Number.....	91	129
Percent.....	21. 6	22. 6
Population served....	6, 805, 670	11, 052, 764
Percent.....	11. 0	13. 4

Supply source—Con.	1948	1955
Surface:		
Number.....	276	339
Percent.....	65. 4	59. 5
Population served....	39, 678, 185	52, 501, 026
Percent.....	64. 1	63. 5
Ground and surface:		
Number.....	55	102
Percent.....	13. 0	17. 9
Population served....	15, 380, 355	19, 093, 962
Percent.....	24. 9	23. 1
<i>Water status</i>		
Treated:		
Number.....	392	548
Percent.....	92. 9	96. 1
Population served....	52, 185, 360	81, 247, 494
Percent.....	84. 4	98. 3
Untreated:		
Number.....	12	14
Percent.....	2. 8	2. 5
Population served....	682, 270	714, 844
Percent.....	1. 1	. 9
Treated and untreated:		
Number.....	18	8
Percent.....	4. 3	1. 4
Population served....	8, 996, 580	685, 378
Percent.....	14. 5	. 8

<sup>1</sup> 1940 census.    <sup>2</sup> 1950 census.

to the top of this tower, the lecturer was able, in effect, to put the audience at the bottom of a well.

Subjects covered were:

- Water-supply protection and sewage disposal.
- Fundamentals of water systems.
- Selection of pneumatic tanks.
- Types of air volume controls and their correct use.
- Plastic pipe and its correct application.
- Pump location, housing, and protection.
- Selecting the pump with the necessary capacity and calculating suction lift and discharge head.
- Planning the farmstead distribution system.

Demonstrations presented were:

- Effects on pump operation of increasing suction lift and discharge pressure and of elevation of the pump.
- Airlogging and waterlogging of pneumatic tanks.
- The submersible pump.
- Pipe friction in various kinds of pipe.
- Wiring and motor protection.

In addition, each person at each workshop received a folder with some 20 pieces of literature on pumping equipment and pump installation.

Fifteen of these intensive 1-day workshops were held in Mississippi, with more than 350 leaders attending. One meeting was held at Mississippi State College, another at a Future Farmers of America camp, and the remainder at vocational agriculture departments of high schools.

## Results

Perhaps the main benefit of this coordinated activity has been the establishment of effective day-to-day working relationships among the various participating agencies. While all of these agencies have a common interest—improvement of rural living—each individual agency has specialized fields of interest which contribute to achieving this goal of better rural life. It is the concentration of all these specialized talents on one particular aspect of rural life—the problem of sanitation and the general

benefits of pressure water systems—that seems to stand out as a major accomplishment.

It is too early to evaluate completely the effects of this activity on rural sanitation in northeastern Mississippi. This is obviously a long-range program, one which requires constant effort for a number of years. It requires followup calls and renewed activity each year. The program is not yet complete, and further results will be seen.

However, some facts are available, based on a study of 21 counties in northeastern Mississippi. This study, made from reports of sanitarians in these counties, shows the following results during the calendar year 1954.

1. Of all pressure water systems installed in the 21 counties in 1954, approximately 50 percent were installed in the 3 counties where the postcard survey was made on a countywide basis. Another 27 percent of the pressure water systems were installed in 5 other counties where the postcard survey was made in 10 to 25 percent of the county. In the remaining 13 counties, only 23 percent of the total pressure water systems were installed. Thus, more than three-fourths of the pressure water systems installed in these 21 counties in 1954 were in the 8 counties where the survey was made in all or part of the county; less than one-fourth of the pressure water systems were installed in the other 13 counties.

2. The statistics on installation of protected water supplies is even more impressive. In many cases, the sanitarian, who made a call to a farm after the postcard survey, found that improvements in the protection of farm water supply had already been made—in the interval between the farmer's mailing back the postcard and the visit of the sanitarian.

In the matter of protecting water supply, 55 percent of the improvements came in the 3 counties where complete countywide postcard surveys were made. Another 27 percent of improvements were in the 5 counties where surveys were made in part of the county. The remaining 13 counties produced only 18 percent of the improvements in protection of water supplies in 1954. Thus, the 8 counties where the survey was made in all or part of the county received 82 percent of the improvements in water supply protection, and the other 13 counties had only

\* Special report on mental patients in public hospitals for mental disease, fiscal 1955

State	First admissions	Readmissions	Discharges	Deaths in hospital	Resident patients, end of year	Average daily resident patient population	Total full-time personnel, end of year	Maintenance expenditures	
								Total	Per capita <sup>1</sup>
Totals.....	123, 771	55, 158	118, 532	44, 488	560, 576	556, 364	145, 032	\$622, 603, 423	\$1, 119. 06
Alabama.....	<sup>2</sup> 1, 417	<sup>2</sup> 625	<sup>2</sup> 1, 131	<sup>2</sup> 428	<sup>2</sup> 7, 209	<sup>2</sup> 7, 151	<sup>2</sup> 1, 212	<sup>3</sup> 4, 778, 285	668. 20
Arizona.....	680	265	1, 074	156	1, 690	1, 701	504	2, 086, 106	1, 226. 40
Arkansas.....	1, 600	686	1, 900	338	5, 086	5, 017	1, 398	4, 528, 186	902. 57
California.....	<sup>2</sup> 12, 064	<sup>2</sup> 5, 455	<sup>2</sup> 14, 153	<sup>2</sup> 2, 836	<sup>2</sup> 37, 317	<sup>2</sup> 36, 497	<sup>2</sup> 9, 343	<sup>2</sup> 44, 825, 771	1, 228. 20
Colorado.....	1, 207	400	1, 292	518	5, 720	5, 714	1, 876	7, 316, 692	1, 280. 49
Connecticut.....	2, 418	1, 436	3, 103	955	8, 694	8, 958	2, 968	<sup>4</sup> 14, 108, 591	1, 574. 97
Delaware.....	<sup>2</sup> 660	<sup>2</sup> 301	<sup>2</sup> 674	<sup>2</sup> 202	<sup>2</sup> 1, 808	<sup>2</sup> 1, 762	<sup>2</sup> 686	<sup>2</sup> 2, 459, 573	1, 395. 90
District of Columbia.....	1, 022	327	748	502	7, 285	7, 216	2, 563	13, 634, 554	1, 889. 49
Florida.....	1, 748	474	200	514	8, 026	7, 912	2, 046	6, 971, 537	881. 13
Georgia.....	2, 878	684	2, 480	858	11, 701	11, 582	1, 926	9, 639, 192	832. 26
Idaho.....	713	383	891	124	1, 211	1, 260	327	1, 426, 063	1, 131. 80
Illinois.....	8, 290	4, 703	9, 669	3, 509	37, 883	38, 001	8, 405	37, 715, 662	992. 49
Indiana.....	2, 822	1, 237	2, 214	759	11, 120	10, 765	3, 668	13, 513, 547	1, 255. 32
Iowa.....	1, 500	1, 186	2, 048	473	5, 251	5, 395	1, 774	<sup>4</sup> 6, 273, 756	1, 162. 88
Kansas.....	1, 040	474	1, 046	288	4, 420	4, 462	2, 090	7, 660, 225	1, 716. 77
Kentucky.....	1, 396	1, 002	1, 719	593	7, 700	7, 689	1, 497	5, 026, 937	653. 78
Louisiana.....	2, 081	696	1, 909	424	8, 290	8, 184	1, 883	5, 926, 021	724. 10
Maine.....	534	264	504	258	2, 996	2, 983	800	3, 198, 821	1, 072. 35
Maryland.....	<sup>2</sup> 2, 387	<sup>2</sup> 1, 053	<sup>2</sup> 2, 452	<sup>2</sup> 720	<sup>2</sup> 9, 599	<sup>2</sup> 9, 511	<sup>2</sup> 2, 580	<sup>2</sup> 11, 279, 506	1, 185. 94
Massachusetts.....	6, 515	1, 951	6, 224	2, 393	23, 302	23, 195	7, 119	32, 396, 007	1, 396. 68
Michigan.....	3, 142	1, 486	2, 519	1, 451	21, 788	21, 441	6, 261	32, 023, 989	1, 493. 59
Minnesota.....	2, 915	1, 464	3, 025	1, 002	11, 449	11, 524	2, 862	12, 688, 145	1, 101. 02
Mississippi.....	1, 905	1, 560	2, 406	346	5, 295	5, 296	1, 381	3, 856, 231	728. 14
Missouri.....	1, 346	475	1, 283	692	12, 046	12, 092	2, 857	10, 661, 817	881. 72
Montana.....	<sup>3</sup> 618	<sup>3</sup> 160	<sup>3</sup> 584	<sup>3</sup> 198	<sup>3</sup> 1, 958	<sup>3</sup> 1, 942	<sup>3</sup> 446	<sup>3</sup> 1, 800, 898	927. 34
Nebraska.....	963	881	709	411	4, 826	4, 806	1, 800	5, 511, 654	1, 146. 83
Nevada.....	207	30	173	47	440	429	91	474, 819	1, 106. 80
New Hampshire.....	666	274	623	274	2, 720	2, 703	861	3, 572, 007	1, 321. 50
New Jersey.....	5, 089	2, 068	4, 277	2, 502	22, 262	22, 257	7, 455	28, 389, 142	1, 275. 52
New Mexico.....	439	458	850	97	1, 067	1, 087	412	1, 378, 817	1, 268. 46
New York.....	16, 371	5, 996	10, 163	8, 160	96, 729	95, 890	24, 305	118, 761, 495	1, 238. 52
North Carolina.....	2, 301	965	2, 522	445	10, 788	9, 913	2, 733	10, 074, 051	1, 016. 25
North Dakota.....	541	236	340	127	1, 993	2, 022	461	1, 939, 268	959. 08
Ohio.....	7, 191	2, 987	7, 682	2, 044	28, 663	28, 367	7, 453	29, 562, 280	1, 042. 14
Oklahoma.....	1, 239	860	1, 273	520	8, 014	7, 919	2, 068	6, 584, 482	831. 48
Oregon.....	1, 991	828	1, 992	530	4, 906	4, 818	1, 264	5, 107, 050	1, 059. 99
Pennsylvania.....	5, 499	2, 209	3, 639	2, 813	40, 920	40, 448	10, 721	44, 753, 492	1, 106. 45
Rhode Island.....	898	488	909	400	3, 442	3, 422	790	3, 199, 733	935. 05
South Carolina.....	1, 727	556	1, 594	382	6, 038	5, 966	1, 245	4, 764, 533	798. 61
South Dakota.....	<sup>3</sup> 430	<sup>3</sup> 198	<sup>3</sup> 643	<sup>3</sup> 152	<sup>3</sup> 1, 595	<sup>3</sup> 1, 696	<sup>3</sup> 473	<sup>3</sup> 1, 521, 821	897. 30
Tennessee.....	1, 885	1, 197	2, 300	537	8, 370	8, 531	1, 244	4, 992, 914	585. 27
Texas.....	3, 835	1, 437	4, 220	976	16, 445	16, 466	3, 637	14, 917, 351	905. 95
Utah.....	<sup>3</sup> 308	<sup>3</sup> 113	<sup>3</sup> 258	<sup>3</sup> 106	<sup>3</sup> 1, 359	<sup>3</sup> 1, 342	<sup>3</sup> 380	<sup>3</sup> 1, 384, 322	1, 031. 54
Vermont.....	348	167	374	125	1, 294	1, 290	343	1, 387, 096	1, 075. 27
Virginia.....	2, 276	1, 510	2, 290	813	11, 303	11, 067	2, 442	9, 257, 022	836. 45
Washington.....	1, 591	771	1, 682	743	7, 361	7, 496	1, 823	7, 827, 415	1, 044. 21
West Virginia.....	<sup>2</sup> 1, 701	<sup>2</sup> 677	<sup>2</sup> 1, 736	<sup>2</sup> 399	<sup>2</sup> 5, 545	<sup>2</sup> 5, 495	<sup>2</sup> 1, 054	<sup>2</sup> 3, 667, 045	667. 34
Wisconsin.....	3, 194	1, 407	2, 864	1, 270	15, 013	15, 036	3, 364	17, 208, 599	1, 144. 49
Wyoming.....	<sup>3</sup> 183	<sup>3</sup> 95	<sup>3</sup> 171	<sup>3</sup> 78	<sup>3</sup> 639	<sup>3</sup> 648	<sup>3</sup> 141	<sup>3</sup> 570, 900	881. 02

<sup>1</sup> Per capita maintenance expenditure was computed by dividing total maintenance expenditure by the average daily resident patient population in each State.

<sup>2</sup> Estimated by using data reported in the 1954 census of mental patients for those hospitals not supplying the special survey data for 1955 and using the 1955 survey data for those hospitals which did report.

<sup>3</sup> Estimated by using data reported for the 1954 census of mental patients since the hospitals in the State did not report in the special survey for 1955.

<sup>4</sup> Estimated by applying, where required, the percentage change reported for similar data in the 1953 and 1954 census of mental patients to the 1954 figure since the hospitals in the State concerned did not supply the item requested.

NOTE: These data are provisional and subject to change. Public hospitals include the State and county hospitals for mental disease and the psychopathic hospitals.

# Mental Patient Data for Fiscal Year 1955

ON THE BASIS of summary data submitted to the National Institute of Mental Health of the Public Health Service by the various State mental hospital systems for fiscal year 1955, figures in basic categories show a substantial increase over the year before.

Item	1954	1955	Percentage increase
First admissions..	121,430	123,771	1.9
Readmissions....	50,252	55,158	9.8
Discharges.....	115,796	118,532	2.4
Deaths in hospitals..	42,652	44,488	4.3
Resident patients at end of year..	553,979	560,576	1.2
Personnel employed full time at end of year..	138,053	145,032	5.1
Maintenance expenditures:			
Total.....	\$569,490,492	\$622,603,423	9.3
Average per capita.....	\$1,038.62	\$1,119.06	7.7

Heretofore there has been a considerable time lag in publishing mental health statistics. Since data are needed on an up-to-date basis, public mental hospitals were asked on recommendation of mental hospital statisticians in their fifth annual conference, May 1955, to provide certain basic figures after the close of each

year: first admissions, readmissions, total discharges from the hospitals and deaths in the hospitals during the year; average daily resident population; resident patients and total personnel employed full time at the end of the year; and total maintenance expenditures for patients.

The National Institute of Mental Health made the survey in October 1955.

It was realized that final and complete data might not be available because of variation in reporting procedures and fiscal year-ending dates. Therefore, the hospitals were requested, if the answers to any or all of the items were unknown at the time of the survey, to enter their best estimates. However, some hospitals found it impossible either to report any estimate for a given item or to report at all. Since these data were to provide some measure of the extent of hospitalization in State and county hospitals for mental disease and the psychopathic hospitals, the institute attempted to provide rough estimates of the missing data. This was done in one of three ways:

1. If one or two requested items were not available and all other items were supplied, estimates of the missing 1955 data were made by extrapolation, using the 1953 and 1954 census figures.

2. If some hospitals within the State reported and some did not, the 1954 data from the census of mental patients were used for hospitals not reporting.

3. If no report was made for a State in the survey, the 1954 census data were used.

The table shows figures for each State and the type of estimation procedure used.

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*This special Public Health Service report was made by the Hospital Reports and Records Unit, Current Reports Section, Biometrics Branch, National Institute of Mental Health, Bethesda, Md. The unit is interested in comments on the report and its continuation.*

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# Urinary Excretion of Fluoride Following Defluoridation of a Water Supply

By R. C. LIKINS, D.D.S., F. J. McCLURE, Ph.D.,  
and A. C. STEERE, B.S.

PREVIOUS studies have shown that essentially all absorbed fluoride is eliminated in the urine or deposited in skeletal and dental tissues (1-3). That all fluoride deposited in the skeleton is not fixed irreversibly is shown by its mobilization following a reduction in fluoride intake (1, 3-9). Brun and his associates (4) reported that men who had absorbed fluoride from cryolite dust maintained a high level of fluoride in the urine for as long as 7 years following the period of exposure. Similarly, Largent and Heyroth (3) and Largent (5) found that urinary excretion of fluoride in excess of the intake continued at a progressively decreasing rate for as long as 2 years after the ingestion of large amounts of fluoride. Blake-more and his co-workers (6) observed that in cattle the fluoride content of the urine remained high for some time after they had foraged on pastures contaminated with industrial fluoride dust. Direct evidence of the withdrawal of

fluoride from bone has been obtained in cattle (6) and in rats (7-9).

It was not ascertained by these studies whether or not any factors in association with a reduction in fluoride intake influenced the mobilization of fluoride. It may be surmised, however, that variations in the metabolic activity of skeletal tissue due to age could alter the process. In support of this assumption there is extensive evidence that the degree of skeletal maturation affects the deposition and retention of ions other than fluoride normally present in calcified tissues (10).

The purpose of the present study was to investigate the relationship of age to the rate of mobilization of fluoride in a human population group exposed to an excessive amount (8 p.p.m.) of waterborne fluoride.

## Organization of the Study

For more than 50 years before defluoridation was begun on March 10, 1952 (11), the communal water supply of Bartlett, Tex., contained 8 p.p.m. fluoride. Since this date the fluoride in the water has been maintained at approximately 1 p.p.m.

One hundred and sixteen white males who had used the Bartlett water supply for at least 2 years immediately prior to defluoridation and who were currently drinking Bartlett water composed the study population. Their numerical distribution according to age group, to-

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*The authors are with the Laboratory of Oral and Biological Chemistry, National Institute of Dental Research, Public Health Service. Dr. Likins is engaged in research pertaining to mineral metabolism and the chemistry of calcified tissue. Dr. McClure, who has been studying fluoride and dental caries for many years, is chief of the laboratory. Mrs. Steere, a biologist, is assisting in the laboratory's research projects.*

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# World Health Day || "Destroy Disease Carrying Insects"

April 7, 1956



Many diseases cannot be spread without insect vectors. They are among the most ancient afflictions of mankind and have played their part in shaping his history. Malaria has influenced the rise and fall of civilizations. Epidemics of plague and of yellow fever have again and again decimated populations in the old and the new worlds, while outbreaks of louseborne typhus have often determined the outcome of military campaigns. Sleeping sickness and the less well-known disease onchocerciasis have held back progress on the African continent.

These and a score of other diseases carried by flying and crawling insects have enfeebled whole sections of the human race, depopulated fertile food-producing tracts, and held down man's levels of living particularly in the tropics but also in temperate climates. Despite the strides that have been made in our own day towards the control of many of these scourges, there is scarcely one which does not still represent an actual or potential danger to large numbers of human beings.

Most of these diseases have been known and feared for centuries, but it was only in the early years of the present century that painstaking research established with certainty the part of many different species of insects, such as mosquitoes, tsetse flies, sandflies, fleas, and lice, as well as of ticks, and mites, in transmitting a great number of pestilences.

In the first flush of enthusiasm following these discoveries it was thought that, once the carrier was known, any disease would be virtually conquered.

Indeed, in a relatively short time yellow fever was banished from most of the cities of the Americas. The incidence of malaria was reduced particularly in the towns and in the more temperate zones, and certain other diseases were successfully attacked.

Rapid progress, however, became possible

only after the discovery during World War II of the "residual" insecticides, of which the best known probably is DDT. The special character of these chemicals is that they remain deadly for periods ranging up to several months after application. One of their first triumphs was to strangle the threat of typhus epidemics during and after the war. Next, they proved amazingly effective when correctly used to control malaria, even in the sparsely settled rural districts. There is scarcely an insectborne disease against which these new chemicals are not being used today with greater or less effect.

But again disappointment has followed too optimistic hopes. First, the common housefly and now some mosquitoes as well as lice, cockroaches, and bedbugs in certain areas have shown that, after a few years of exposure, they can develop resistance which protects them from fatal effects. For the housefly, resistance occurs rather quickly, and these chemicals have therefore become of little value. With the mosquito, however, the insecticides can be used effectively for several years. During this period an all-out campaign can eradicate diseases such as malaria.

It would be a serious mistake to underestimate insectborne diseases. It is already clear that the residual insecticides, powerful weapons though they be, do not provide the final answer to the disease-carrying insect.

World Health Day this year will, I hope, serve to make people everywhere realize that, although the insectborne diseases are being increasingly held in check, they are not yet conquered. To achieve that final victory, man will need all his intelligence and resourcefulness. Above all, he will need to act in concert, for this group of diseases constitutes one of the greatest challenges to international health action.

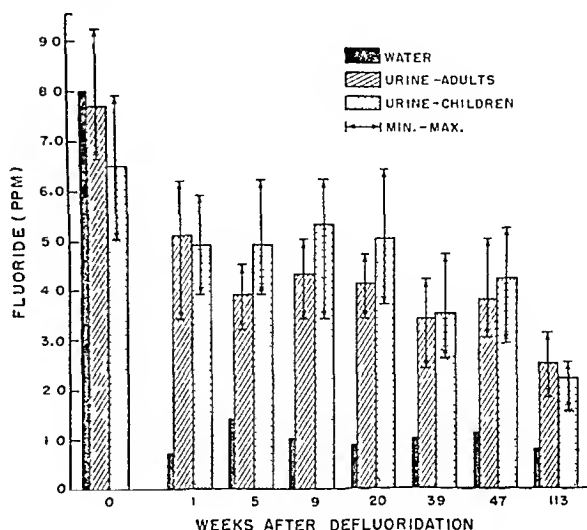
—By M. G. CANDAT, M.D., *Director-General, World Health Organization* (abridged statement).

values agrees with previous reports that urinary excretion of fluoride continued to be high after a marked reduction in the fluoride intake. It also indicates that fluoride is being mobilized from the skeletal tissues of the Bartlett residents.

There was no apparent correlation of age with urinary excretion of fluoride within either the group 7 through 16 years of age or the group aged 20 years and over. When the mean fluoride values for these two groups are compared, however, it will be noted that during the first 20 weeks the urinary excretion of fluoride decreased somewhat less precipitously in children than in adults. This finding suggests that the degree of mobilization of skeletal fluoride was somewhat greater in children than in adults during this period.

It has been suggested that the withdrawal of fluoride from bone can be attributed to (a) exchange phenomena in which fluoride ions on the surface of the apatite crystals exchange with hydroxyl ions in the extracellular fluids and (b) to the basic resorption-deposition cycle of the skeleton (16). Since this latter process is identified with bone growth and reconstruc-

# Fluoride content of water and urine at specified intervals after defluoridation of the water supply in Bartlett, Tex.



tion, it seems probable that exchange is the principal mechanism concerned in the mobilization of fluoride from the mature skeleton. On this basis the initial rapid decrease in the urinary concentration of fluoride in adults presum-

**Table 3. Fluoride content of urine (in p.p.m.) for specified age groups after defluoridation of drinking water**

Age group (years)	Number of weeks after defluoridation							
	0	1	5	9	20	39	47	113
	(Mar. 10, 1952)	(Mar. 17, 1952)	(Apr. 14, 1952)	(May 15, 1952)	(July 25, 1952)	(Dec. 9, 1952)	(Feb. 4, 1953)	(May 11, 1954)
7-----	6.9	3.9	4.6	5.3	3.9	3.9	4.0	2.5
8-----	5.5	5.0	4.9	6.2	5.6	2.6	4.8	2.2
9-----	5.6	4.5	3.9	3.4	4.3	2.9	3.0	2.2
10-----	6.1	4.3	4.2	4.9	4.8	3.5	4.0	2.1
11-----	7.2	5.1	5.0	5.4	6.4	3.0	4.2	2.4
12-----	7.9	5.1	5.0	6.0	4.8	3.5	3.9	2.1
13-----	6.1	5.2	5.5	5.7	5.3	4.7	5.2	2.0
14-----	7.7	4.8	6.2	5.2	3.7	4.0	5.0	1.5
15-----	7.1	5.9	4.8	5.5	5.3	3.2	3.8	2.5
16-----	5.0	4.7	4.7	5.6	5.7	3.8	3.7	2.1
Average-----	6.5	4.9	4.9	5.3	5.0	3.5	4.2	2.2
20-29-----	6.8	3.4	3.8	4.1	4.0	3.6	3.5	2.7
30-39-----	8.2	4.4	3.3	3.4	3.7	3.2	3.4	1.8
40-49-----	9.2	5.7	4.5	5.0	4.7	4.2	-----	2.1
50-59-----	6.6	5.3	4.4	4.4	4.2	3.8	5.0	2.6
60-69-----	8.5	5.4	4.1	4.7	3.4	2.4	3.9	2.6
70 and over-----	7.0	6.2	3.2	3.9	4.5	3.4	3.0	3.1
Average-----	7.7	5.1	3.9	4.3	4.1	3.4	3.8	2.5



**Table 1. Age distribution of the study group and exposure to 8 p.p.m. fluoride in drinking water**

Age group (years)	Number of persons	Number of years of exposure		
		Maximum	Minimum	Mean
7-----	9	7	7	7
8-----	7	8	2	6
9-----	6	9	2	6
10-----	9	10	4	7
11-----	4	11	4	9
12-----	5	12	6	10
13-----	7	13	2	9
14-----	3	14	5	11
15-----	9	15	9	13
16-----	6	16	7	12
20-29-----	8	20	5	12
30-39-----	7	28	4	11
40-49-----	13	47	8	26
50-59-----	7	57	4	32
60-69-----	7	50	4	30
70 and over-----	9	50	4	34

gether with data relative to duration of exposure to the untreated water, is shown in table 1.

On the day defluoridation was begun (which was, of course, before the defluoridation process had changed the fluoride content of the water supply) and at intervals thereafter during the next 113 weeks, a spot urine specimen was obtained from each person in the study. Aliquots of the specimens were pooled by age groups and analyzed for fluoride by standard procedures (12, 13), with calcium hydroxide (1 gm. per 100 ml. urine) employed as the fluoride fixative.

## Results

The mean daily fluoride content of the treated water in Bartlett during the period of

observation was 1.32 p.p.m. The average fluoride content for each month is given in table 2.

The urinary fluoride values for each age group appear in table 3, and the means for all children, ages 7 through 16, and all adults, ages 20 and over, are shown in the chart. This division of the study population into children and adults was based on the fact that skeletal maturation is complete by approximately 18 years of age (14).

On the day defluoridation was begun, the fluoride content of the urine samples ranged from 5.0 to 9.2 p.p.m. and averaged 6.5 p.p.m. in children and 7.7 p.p.m. in adults. One week later, the water contained 0.7 p.p.m. fluoride, and the mean concentration of urinary fluoride had decreased to 4.9 p.p.m. in children and 5.1 p.p.m. in adults. After 5 weeks the mean urinary fluoride concentration remained unchanged in children but had decreased to 3.9 p.p.m. in adults. No further changes were apparent at the end of 9 weeks and 20 weeks, but the fluoride content of the urine had decreased in both children and adults after 39 weeks. After 113 weeks, the average concentration of fluoride in the urine was 2.2 p.p.m. in children and 2.5 p.p.m. in adults.

## Discussion

It has been shown that persons whose drinking water contained 0.5 to 5.1 p.p.m. fluoride excreted fluoride in the urine approximately equal in concentration to that in the drinking water (15). On the basis of this evidence, the urine of the Bartlett residents would be expected to contain 1.0-1.5 p.p.m. of fluoride following defluoridation of their drinking water. The fact that the urinary concentrations of fluoride considerably exceeded these expected

**Table 2. Average monthly concentrations of fluoride (p.p.m.) in the water supply of Bartlett, Tex., after defluoridation**

Year	January	February	March	April	May	June	July	August	September	October	November	December
1952-----			1.75	0.98	1.08	1.28	1.50	1.46	1.30	1.74	1.41	1.23
1953-----	1.13	1.08	1.26	1.17	1.09	1.39	1.48	2.13	1.27	1.14	1.30	1.36
1954-----	1.16	1.43	1.24	1.25	1.06							



# *Where are we going in public health?*

THE CHRONIC DISEASES, mental disorders, medical rehabilitation, and the consequent need to evaluate and reevaluate all public health programs constitute, it seems to me, urgent challenges that confront our profession. We cannot do less than to face these challenges with resolution and daring. The courage to do what is necessary is as basic to the character of our organization as it is to the moral fabric of the individual spirit.

HERMAN E. HILLEBOE, M.D.  
*President, American Public Health Association  
1954-1955  
From the presidential address to the  
American Public Health Association at the  
Eighty-third annual meeting, November 15, 1955.*

a topical  
and selective  
report of the  
83d  
annual meeting  
of the  
AMERICAN  
PUBLIC  
HEALTH  
ASSOCIATION  
and related  
organizations  
held at  
Kansas City, Mo.  
Nov. 14-18, 1955

ably reflects the loss of readily exchangeable, surface-bound fluoride, whereas the somewhat less precipitous drop in children may be the consequence of the progressive liberation of fluoride from bone through resorptive activity.

## Summary

The urinary excretion of fluoride was determined in children, ages 7-16 years, and in adults, ages 20 years and older, following the reduction of fluoride in their drinking water from 8 p.p.m. to approximately 1 p.p.m. During a period of 27 months, the concentration of fluoride in urine specimens decreased from 6-8 p.p.m. to approximately 2 p.p.m. The urinary fluoride values during the period were considerably higher than would be expected for a corresponding group with no prior exposure to high levels of fluoride. These values indicate that previously stored fluoride was being mobilized. There was no apparent relation between age and urinary fluoride excretion within either group. However, the extent of mobilization appeared to be greater in children than in adults.

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# Goals and Issues . . .

## Fight Chronic Ills Now, APHA President Urges

APHA President Herman E. Hilleboe, M.D., New York State health commissioner, in his address of welcome, pinpointed challenging and complex public health problems which, he said, call for shrewd collective analysis and planning: chronic ill, mental health, rehabilitation, and evaluation.

Historic achievements in public health, minimizing the threat of communicable disease, Hilleboe said, have permitted more and more children to live to maturity. The result: public health work of the future must deal more and more with mature persons among whom chronic disease and disability are prevalent.

"Our public health programs must encompass the degenerative diseases and the long-term illness," Hilleboe said. "We cannot delay longer, or we will be hopelessly overwhelmed."

### Chronic Diseases

The special problem in the prevention of chronic diseases is prevention of progression of the major causes of death, chiefly cancer, diseases of the heart, and cerebral vascular lesions, he said. Rehabilitation plays a predominant role in the prevention of other chronic ailments—arthritis, neuromuscular disorders, and diabetes, he added.

"As we apply new knowledge of cancer, we lengthen the life of affected individuals and increase the magnitude of the problems of chronic disease and especially rehabilitation," he pointed out. "The increase in life expectancy offers benefits to the individual, but at the same time it adds social and economic responsibilities for the community and State," he said.

Truly preventive geriatrics should begin during early adult life with sound health programs directed

against the chronic diseases as they begin to attack the aging body, he said, citing the pilot studies on atherosclerosis in Minnesota, the multiple screening studies in Virginia, the broad chronic disease program in California.

In Hilleboe's opinion, projects similar to the New York State research in cardiovascular disease, at the Albany Medical College, should be a vital part of all large health departments.

"What is the purpose of such a project?" he asked. "First of all, it gives a preventive service to State employees; but equally important, it is a research effort to learn how best to detect heart disease at an early stage and to develop new methods of effective and economical screening to find cardiac disease."

"We hope to gain basic knowledge of the preventive aspects of coronary artery disease and hypertension. We use this research project for the teaching of medical students and also for postgraduate education of general practitioners and health officers in the area. This is the type of project which should be a vital part of larger health departments, so that they may better meet the challenge of this crucial public health problem."

The theme "Where are we going in public health?" was a wise choice for the annual meeting of the American Public Health Association, Hilleboe remarked. The APHA Committee on Administrative Practice is sponsoring a study on what official and voluntary health agencies are doing on a communitywide basis to meet the problems of chronic illness, he noted. In 1956, the association plans to use its journal and newsletter, meetings of regional groups, State societies, and expert committees to bring the challenge of public health in a changing world to health workers everywhere, he added.

## Mental Health

The establishment of a mental health section within the organization structure of APHA is also an encouraging sign, he remarked, and made the following comments:

"It has been estimated that some 25 percent of the Nation's labor force suffers from some form of emotional disturbance. This situation and its attendant dislocations, in terms of wages paid for no productive results and in terms of damage to men and machines, cost industry billions of dollars a year."

"Every year a quarter of a million new patients enter mental institutions. Our mental health experts tell us that one out of every 12 persons will sometime during his life become a mental hospital patient, and that in the United States today there are some 10 million persons suffering mental illnesses or disorders. The personnel and facilities fall far short of the demands of these people who are swelling the ranks of the chronically ill."

In commenting that the public health movement has not done nearly enough to cope with the agonizing issues of mental disease, Hilleboe stated that public health and mental hygiene authorities in the States are complementary and never should be competitive. He urged close and continuing collaboration.

Other challenges to the public health profession Hilleboe discussed are the pressing demands for medical rehabilitation and the need to discover more precise tools with which to evaluate and reevaluate public health problems.

## Rehabilitation

On rehabilitation, he had this to say:

"Public health physicians need to have an appreciation of the important part played by family doctors in this field. Public health workers can serve best by supplementing and enhancing the work of the family physician. Medical rehabilitation, viewed in this broad perspective, is a synthesis of the skills of the family

# The APHA Conference Report

Highlights of more than 130 papers presented at the 83d annual meeting of the American Public Health Association and related organizations, at Kansas City, Mo., November 14-18, 1955, are published in the following pages. *Public Health Reports* here seeks for the fifth successive year to provide a compressed but comprehensive review of the Nation's major annual public health meeting.

It is intended that this information shall be helpful not only to the multitude who did not attend the conference but even to the few thousand guests and delegates at Kansas City who regrettably found it

impossible to attend more than one meeting at one time, not to mention luncheons, dinners, business meetings, discussions, and exhibitions.

Our editors have, with the assistance of the authors, selected and summarized the salient points of available papers for summation. The papers are arrayed below as nearly as possible according to the topical or professional interests they affect. To avoid repetition, we have refrained from identifying the sections or organizations which sponsored these papers, but a list of the sections and most of the organizations is published below.

## Sections of the American Public Health Association

Dental Health	Laboratory	Public Health Education
Engineering and Sanitation	Maternal and Child Health	Public Health Nursing
Epidemiology	Medical Care	School Health
Food and Nutrition	Mental Health	Statistics
Health Officers	Occupational Health	

## Related Organizations Participating in the Conference

<i>Associations</i>		
American Association of Hospital Consultants	Association of State and Territorial Public Health Nutrition Directors	Public Health Veterinarians
American Association of Public Health Physicians	Association of State Maternal and Child Health and Crippled Children's Directors	State Directors of Public Health Education
American Association of Registration Executives	National Association of Sanitarians	State and Provincial Public Health Laboratory Directors
American School Health Association	National Tuberculosis Association	State Sanitary Engineers
Association of Business Management in Public Health	Public Health Cancer Association	<i>Others</i>
Association of Labor-Management Medical Care Program Administrators		American College of Preventive Medicine
Association of Schools of Public Health	<i>Conferences</i>	Military Government-Civil Affairs
	Health Council Work	Public Health Society
	Medical Care Teaching	National Citizens Committee for the World Health Organization
	Municipal Public Health Engineers	National Health Council
	Nurse Directors	National Sanitation Foundation

The faith that knowledge of people is knowledge for people is for the psychologist a mundane practicality which coincides with the liberal democratic tradition.

The layman is already ahead of the professional in the quest for creative health. The profession is undertaking to apply behavioral knowledge for public use through such operations as the personnel and testing projects of the APHA testing office, the Behavioral Studies Section of the Public Health Service, and the Joint Council on Behavioral Science in Public Health.

## Population Shifts Compel Review of Health Goals

Quantitative and qualitative changes in the United States population demand reappraisal of our ideas about basic health services and a basic health staff, declared John J. Hanlon, M.D., M.P.H., chief, Public Health Division, International Cooperation Administration.

Concerning the continued absolute and relative increase in the older population, Hanlon noted that in 1900, only 18 percent of our population was over 45 years of age, whereas today the figure is 30 percent. By 1975, an estimated one-half of our labor force will be over 40 years of age.

He stated that public health has been doing little more than "dabbling about in the vast area of adult health, chronic diseases, and geriatrics."

The recent upward trend in births indicates that all types of maternal and child health services not only must remain but must expand, Hanlon continued. The annual number of births is expected to reach 6 million by 1975.

Considering current personnel shortages and the prospective increase in population to 210 million or 230 million by 1975, Hanlon estimates that in 20 years we will need

about twice the number of public health workers now on the job.

"A considerable retooling job" by the professional schools is also called for, according to Hanlon. Goals, curriculums, and facilities should be subject to careful scrutiny and analysis, and extensive study should be made of the types of individuals who might be accepted for training, he said.

### *Spatial Changes*

Spatial changes in the population, that is, more or less permanent changes in geographic distribution, have accentuated the gaps in medical and public health personnel and facilities, Hanlon specified. To improve the situation, he urged equitable sharing of support of professional schools and training centers and the development of satisfactory means of transferring accumulated job benefits, such as retirement and pension rights.

Among the several types of spatial change, Hanlon mentioned: the renewed movement of industries and businesses to the west, northwest, and southwest; the northward movement of the American Negroes; and the tendency toward "urban sprawl."

Indicative of population mobility, Hanlon said, is the fact that between April 1950 and April 1951, 21 percent of the population moved to another house. One-third of these families moved to another State or county.

Such changes are a challenge to environmental health, he pointed out. Urban and suburban slums must be avoided, new water and sewerage systems constructed, housing developments supervised, streams and the atmosphere protected against pollution, industrial hygiene and safety services extended to new plants, and entire communities educated in a new setting.

### *Temporal Changes*

Applying the term "temporal change" to temporary population movement, Hanlon noted that temporal population changes give rise to somewhat specialized health prob-

lems—those of the traveler and the migrant worker, for example.

Much remains to be done to make both national and international travel hygienically safe in terms of contacts, food, drink, and waste disposal. The sanitary needs of the traveler lag one or two generations behind improvements in speed and comfort, he said.

Increased worldwide travel may call for reemphasis of global epidemiology, Hanlon suggested. He believes also that more attention to quarantine activities, international standards, and carrier sanitation and examination will be required. Coupled with this work, he said, is technical assistance in health to other countries.

## Urges Stronger Emphasis On Industrial Health

Specific public needs in occupational health and in supervision of medical care were stated in behalf of organized labor by Leonard Woodcock, vice president, United Automobile Workers.

Speaking of labor's experience with occupational health services and with prepayment plans for medical care, he said:

"We urgently need a stepped-up program of industrial health. We need improved standards publicly arrived at. We need active and disinterested enforcement of standards. We need responsibly conducted public research on the key problems of industrial health to determine the extent to which cancer, heart disease, and other major disabilities are work connected. New studies are needed to keep abreast of the changing occupational environment which now exposes people to the risk of radiation and to the hazards of new chemicals and new materials. Improved reporting and detection programs are needed."

He said unions were getting better cooperation on health services from State labor departments than from health agencies. "Without excep-

physician and the public health worker each of whom contributes to the common goal of correcting or retarding the ill effects of disease and disability. This teamwork promotes optimum health for the community through preventive services to its individual citizens.

"Medical rehabilitation of the physically and mentally handicapped calls upon every field of activity in health, vocational service, and welfare. Not only must the many different needs of the disabled individual be met adequately, but the overlapping services require meticulous synchronization.

"Teamwork of the highest order is necessary from the beginning to the end of the rehabilitative process. Immediately after the medical members of the team diagnose disability and make a plan of treatment, the educational members join with their vocational guidance and training. The welfare team members also are concerned from the start with the social problems of the individual and the associated problems in the home in which the disabled lives.

"The same pattern of teamwork is needed among the several departments in State government concerned with medical rehabilitation. The rigidity of antiquated laws and the barriers of traditional practices too often stand in the way of realignment of duties and responsibilities to meet the present-day needs of the disabled. A new approach is essential. . . .

"For public health workers to direct and advise on the medical aspects of rehabilitation in no way interferes with the prerogatives of the guidance counselors, educators, and technicians in the vocational aspects of rehabilitation. Nor does it interfere with the employment experts in the departments of labor or education in the placement programs. Interdepartmental planning can solve these problems of relationship if the departmental representatives will only learn to communicate with one another, share burdens, and divide their responsibilities.

"Every State could benefit from an interdepartmental council in the field of human resources to make full use of available personnel and facilities in medical rehabilitation. Here is a productive enterprise in which public health workers can take the initiative in those States that do not have such interdepartmental council.

"The future success of local health departments throughout the Nation may well depend upon the programs developed to serve citizens with chronic diseases, especially in the field of medical rehabilitation. Indeed, in planning to meet the future health needs of the Nation, let us not forget that a large share of adult medical care consists of medical rehabilitation."

Future success in meeting the challenge of chronic diseases, mental disorders, and medical rehabilitation depends on our collective ability to adapt to current demands and also upon the realism of our analysis and evaluation of the whole structure of public health activities, Hilleboe concluded.

## Rule of Habeas Mentem Protects the Public

In the shape of things to come, public health services will be designed more and more by an informed and insistent public, according to Fillmore Sanford, executive secretary of the American Psychological Association.

Sanford discussed current social trends, their implications for public health, and anticipatory possibilities. This prospect of popular guidance of public health practice, he said, indicated an expanding responsibility for the behavioral sciences.

Increasing freedom from drudgery, increasing freedom from the major killing diseases, advancing levels of education, and increased scientific knowledge of the world, including knowledge of human behavior, he said, have their meaning for the

practitioners as well as the beneficiaries of health services.

The increasing knowledge of behavior, surpassing present understanding of the unconscious, the conditioned reflex, and intelligence, will permit people to improve their predictions of human behavior. As predictions improve, anticipatory action may be expected to improve, too, he commented.

In the public health profession itself, he said, there will be increasing attention to creative action, increasing pressure to change the character of the professions, and an expanding concern with behavior and mental health.

He observed that there are four distinct attitudes in health, productive of characteristic programs: the mood of passive acceptance, the curative attitude, the preventive policy, and the emerging concern with creative potentials, aiming ultimately to develop creative vitality in all living.

In the long tread toward creative health, he foresaw further democratization and secularization of health and welfare work. Informed and independent people, the products of improved education, will not take gracefully to the professional expert who assumes an autocratic role. They will resist prefabricated solutions served on a ritualistic platter, he said.

With such a public, the psychologist may serve best as a teacher and interpreter who can help individuals, in or out of the health profession, to straighten out their own behavior patterns. Such a psychologist observes the principles of habeas mentem, the right of a man to his own mind. Brotherly giving, rather than paternal direction, by the professional is rooted in the continuing advancement of knowledge.

Without progressive growth of knowledge, the professional feels pressure to keep secrets, to cultivate dependency, since such specialized knowledge is power. The best way to insure its use for the public good is to invest the power in the public.

## POPULATION TRENDS

1. Home rule—government in the hands of the people back home, county health departments, decentralization of authority and responsibility.

2. Competence—professionally qualified officials without political motivation.

3. Legislation—to give local communities freedom to act; to place policy decisions in the hands of skilled administrators and professional decisions in the hands of professionals.

4. Problems of the aged—research on industrial retirement practices to determine what should be done about "young men of 65" and "old men of 50."

5. Preventive medicine.

6. Self help—home care programs and other treatments outside the hospital.

7. Mental hygiene.

In all these suggestions, the common theme is that people should be helped to help themselves, Moreell emphasized.

Legislation in 1951 which enabled Pennsylvania to establish county health units Moreell considered the State's most important advance in public health in recent years. "I believe that county health departments are the best mechanism for public health services in many areas," he declared. For example, they serve as effective means for providing service in the two important fields of off-the-job accidents and off-the-job sickness.

### Population Trends Affect Public Health Planning

The volume of internal migration, the great increase in the child population, and the steady increase in the proportion of older persons in this country present actual and potential considerations in planning public health services, according to Robert D. Grove, Ph.D., assistant chief, National Office of Vital Statistics, Public Health Service.

The predominant direction of population migration to the far west and coastal areas, the rapid growth of urban and suburban areas, and the noticeable decline of the rural farm population are outstanding characteristics of population trends, Grove said.

A rapidly growing area is faced with the necessity of expanding its hospital, clinic, nursing, and sanitation services, he commented. It must succeed in obtaining large-scale financing, in convincing local governing bodies that programs of the necessary magnitude should be undertaken, and in getting new residents to share in decisions affecting the community's future. Sometimes, new residents bring with them certain health difficulties that were not previously significant in the community.

The movement to the suburbs usually removes many high income residents from the central cities and may reduce the personal and financial resources for maintaining health services for the city, he continued. This trend represents a hazard not only to the continued provision of health services to the residents of the city but also the health of the many suburban residents who work in the city.

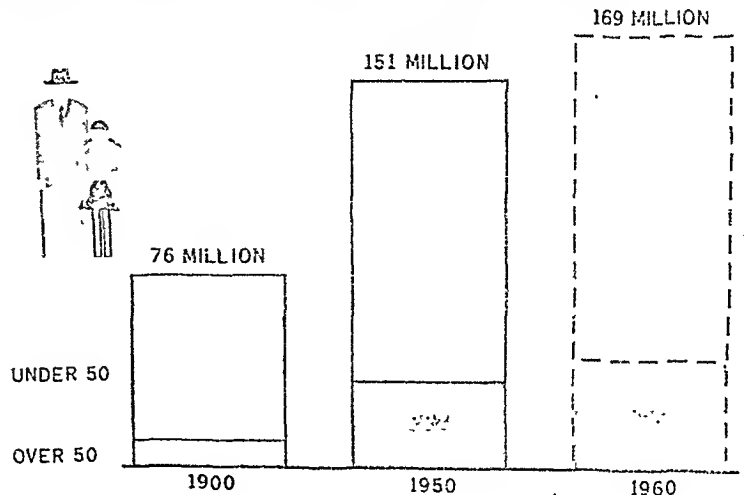
The rural areas, many of which never have had adequate health facilities and services, may find it even more difficult to support them in the face of a declining population, he added. This decline may affect particularly the services for children.

There is reason to believe, he continued, that the number of women entering the childbearing period will begin to increase about 1960 and rise thereafter, and that by 1975 the number of children under 5 years of age will be about one-third more than at present.

One effect of the present tremendous increase in babies and children can be seen in the education field. By 1965, high school enrollment is expected to be about 50 percent higher than in 1955. The wave of additional children has affected needs for school health services, for prenatal care facilities and well-baby clinics, and calls for greatly expanded mental health facilities and larger programs for the prevention of serious accidents.

The number of persons 65 and older can be expected to rise by one-half between 1955 and 1975, he said. Although the attention of health and welfare agencies already is focused on the medical needs of older people, the future will see even greater ne-

## GROWING & AGING POPULATION





tion," he said, "State health departments do not have the staff needed to enforce statutory standards of occupational health and safety." He added that essential information is irrevocably lost because of inadequate reporting of occupational disease.

Speaking of labor contributions to the growth of prepayment plans for health services, he said, "Under health programs negotiated by our union alone, over 3 million workers and dependents have hospitalization and medical coverage. The annual cost of these coverages is about \$130 million. Usually the cost is split between the employer and the worker. The employer's share, however, is part of the worker's compensation; it is an item over which his union conducts collective bargaining and it is paid in lieu of increased wages."

He voiced several familiar criticisms of the operation of prepayment plans, with emphasis on the fact that the subscribers have little capacity to assess the quality of the services and that the plans give far too little attention to preventive services which might enable subscribers to secure effective health services at reasonable costs. He felt that a stronger government interest in the operation of prepayment plans was warranted in view of the fact that subscribers constitute a majority of the population.

Although labor has always favored a system of national health insurance, as the most effective way to obtain comprehensive health services, he said there was no choice but to give the voluntary system a fair trial. However, he added, public health agencies have "an inescapable responsibility concerning the quality of care." And he said they are derelict in developing comprehensive preventive health services.

"Public health should conduct programs of research on how to organize and administer medical care and extend its scope to prevent illness, furnish rehabilitation, and guarantee that institutions and persons licensed to practice do indeed give high quality care," he said.

The issue between national health insurance and the voluntary prepayment plans, he concluded, will be determined in the long run by the availability of broad, voluntary prepaid programs whose scope and quality is assured. "The challenge to public health," he asserted, "is to move into this field as a representative not of the healing arts profession, but on behalf of its citizens."

## An Industrialist Looks At Public Health

Most industrial companies now recognize their obligation to be good neighbors and that "their greatest asset is the health of their employees. They see a direct relationship between efficiency and health, which includes the health of the worker himself and that of the people in his home and in his community," stated Admiral Ben Moreell, chairman of the board, Jones and Laughlin Steel Corporation, Pittsburgh, Pa.

"If we would reap the full benefits of our American traditions, each of us has a moral obligation to contribute, voluntarily and generously, to the preservation of the health of the individuals who make up our society," he said.

Speaking as an industrialist, he said he would list our current major health problems under six headings: (a) the aging population, (b) chronic diseases, (c) mental hygiene, (d) industrial health, (e) hospital and medical care, and (f) prevention of accidents.

"As we assume responsibilities in these areas, we must have the courage to eliminate current programs which deal with obsolete problems," Moreell declared.

He decried the huge expenditures "for 'warehousing' the sick, the tired, the helpless aged, and the indigent," which are "in painful contrast to the meager sums spent for prevention of these disabilities." In Pennsylvania, for example, nearly \$10 million is spent annually for

tuberculosis hospitals. This sum, he said, is sufficient to finance a vigorous preventive campaign that might well end the scourge.

## Industrial Medicine Opportunities

Many industrial health programs too, according to Moreell, are still in the "horse and buggy stage." But there is growing realization that our Nation's 65 million gainfully employed provide an excellent opportunity for the furtherance of effective preventive medicine, he said.

"We regard our industrial health program as one of preventive medicine which cooperates with constructive public health activities," he declared. The goal is conservation, protection, and furtherance of the health and capabilities of the individual worker.

Viewing occupational health as a ally of public health, he stressed the need for greatly expanded cooperation between the two. He mentioned, for example, that inplant medical activities afford important opportunities for mass studies of certain diseases.

"We should proceed with a bold attack on this front in the hope that from mass studies we will obtain knowledge that case-by-case studies have not provided," he asserted.

Another area in which the lessons learned in industry can be applied outside the plant is that of the so-called fringe benefits. "If we could obtain accurate statistical data," he said, "we could avoid many disagreements on objectives and methods and provide greatly improved service to our employees with little increase in cost."

Also needed is research which will tell us how to reduce the cost of medical care without reducing its effectiveness. We have reached the point, he remarked, where we must take definitive action to teach folks how to care for sick people at home, especially in chronic illnesses.

## A Campaign Platform

Moreell suggested the following platform for a campaign to improve public health practices:

Leroy E. Burney, M.D., Assistant Surgeon General, deputy chief of the Bureau of State Services, Public Health Service, said that while recruitment must be stepped up the energies of the professional public health worker must also be redirected in order to gain the fullest use of his service.

He suggested that the professional worker should rely to a much greater extent on the talents of the nontechnical members of the public health team.

"We have hardly begun to appreciate the major contributions that homemakers, nurse aides, practical nurses, business administrators, executive assistants, and sanitarians can make to public health," he said. "By delegating many of the daily operations not directly related to his professional skills, the highly trained worker will be able to devote a much larger part of his valuable time to problems requiring his special competence. Only in this way will the professional worker be able to meet the ever-increasing demands for his services."

## *Trainee Selection*

William C. Cottle, Ph.D., professor of education and assistant director of the guidance bureau, University of Kansas, believes that research into the traits of successful persons in public health occupations will yield material which can be utilized in schools and recruitment and improve staff productivity.

Efforts to date have been concentrated on telling people about, and selling them on, the advantages of careers in public health. Now we need to discover the kind of people who are and are not successful in the varied fields and the traits that make them successful, he said.

Cottle advocated the same scientific research approach to the selection of trainees in public health that are used in identifying, treating, or preventing an infectious disease or in solving any other major scientific problem.

"Before we can award scholarships and fellowships, we need to

know what kind of scholars and fellows we want," he explained. "The range of jobs in public health covers people with varied traits, and a person unsuited for one occupation in public health may have the aptitudes, abilities, and interests that fit him for success in another field of public health."

Cottle also suggested part-time employment of public health workers who become housewives.

Perry Sandell, M.P.H., director of the bureau of dental health education, American Dental Association, stated that future health manpower needs can be more definitely determined after we have been able to make the most effective use of health personnel now available.

"We hear repeatedly of the misuse and waste of the special skills of people engaged in public health work. Not only does this result in ineffective use of personnel, but often results in loss of health personnel because of job dissatisfaction," he said.

## *On the Job Training*

Ross Kandle, M.D., deputy commissioner of health of New York

City, advised that an active accredited residency in preventive medicine is essential in recruiting physicians. The New York State Department of Health, he said, has six young physicians in training for careers in public health.

Kandle also advocated advanced training and education on the job. Well-grounded sanitarians might go to night school in urban areas and with help from a health department become engineers, he pointed out. Nurses recruited at staff level can be helped to get basic training in public health if they and the agencies both believe that adequate training in public health nursing is worth while.

An attractive pension plan is vital in holding a staff, he said, and important in getting people who will have an opportunity to grow on the job.

Also discussed at the session was the Health Career Horizons project of the National Health Council, which is putting information on all health careers within the reach of the Nation's high school students and their parents, teachers, and counselors.

# World Health . . .

## **Eradication of Malaria, A World Health Goal**

Ever since the Interim Commission of the World Health Organization inherited certain malaria control programs from UNRRA in 1946, WHO has placed top priority on helping governments to initiate or expand malaria control programs in all countries in which the disease is a serious problem, declared Louis L. Williams, Jr., M.D., consultant to the Pan American Sanitary Bureau, WHO Regional Office for the Americas.

By the end of 1954, a dozen coun-

tries or territories had eradicated or almost eradicated malaria, and the various agencies assisting malaria control—WHO, UNICEF, and the USICA—now are recommending the abandonment by all countries concerned of the restricted idea of control in favor of intensified campaigns aimed at achieving complete eradication as soon as possible.

## *Growth of the Idea of Eradication*

To illustrate how the concept of eradication has developed, Williams reviewed briefly malaria control activities in the United States from the early years of this century to the

cessity for additional services in this area.

It is necessary to recognize the major trends, but it is important for analytical or administrative purposes to investigate also the variations within the trends, Grove concluded. Among the variations he discussed were the rates of urban (white and nonwhite) population change, the loss in population of many areas, the variation between areas in the rate of child population increase, and the reverse of the decline of medium-sized families.

## Negro Gains Status In Medical Services

Racial integration of medical or health services has progressed notably in the past 20 years, according to limited data obtained by Paul B. Cornely, M.D., Dr.P.H., head of the department of preventive medicine and public health, Howard University College of Medicine, Washington, D. C. It touched a low ebb early in the 1930's, gathered steam in the 1940's, and in the last few years has found general acceptance, at least on a token basis.

In 1930, of 73 Negro graduates of medical schools in the United States, all but 8 received their degrees from Howard or Meharry. For those who were graduates of medical, dental, nursing, and pharmaceutical schools, opportunities to practice were limited. Membership in professional societies was restricted if not closed. Of 7 States surveyed in 1930, 1 employed 2 Negro physicians on a part-time basis and 3 employed 29 Negro nurses.

The quality and number of hospital beds available to Negroes in the southern States was such that, to meet the need, 183 so-called Negro hospitals had been established. Of this number, 20 were approved for intern training. Philanthropic aid for Negro health came almost exclusively from Julius Rosenwald and the Rockefeller Foundation. Voluntary health insurance, which had its

origins in the 1930's, in no way touched the Negro population.

One of many developments toward the end of the decade was the realization that health clinics with Negro patients would enhance results by employing competent Negro professionals, Cornely noted. This reflected, he said, a changing social attitude, accelerated by surveys of needs and costs of medical care and by the emphasis on racial issues in international affairs.

## Medical Doors Opening

In 1946, the American Nurses Association established a direct national membership for nurses who were not admitted to membership in their county societies. The Baltimore County Medical Society in Maryland opened its doors to Negro doctors in 1948. Oklahoma and Missouri followed suit in 1949. The University of Arkansas in 1948 became the first of 26 southern medical schools to admit a Negro student. The number of Negro students enrolled in medical schools in the north increased to 118. Internships and residencies opened in about 16 more institutions in 1948. The Hospital and Construction Act in 1947 included an antidiscrimination clause.

Although the proportion of Negro students in medical schools in 1955 was still small, it was up to 2.5 percent in Michigan. The average was less than 1 percent in the other northern schools. The northern average was about the same as in the southern medical schools, other than Howard and Meharry. Nevertheless, 8 of the once restricted southern medical schools in 1955 had a total of 43 Negro medical students.

All southern State medical societies, with the exception of Louisiana and possibly North Carolina, have opened their rolls to Negro physicians, even though as yet only a minority have taken up membership. Negro nurses and pharmacists are able to join their national professional societies without going through local or county units. The Negro dentist in the south, however,

is still barred from membership in the American Dental Association.

## Patient Care

Negro enrollment in health insurance plans is difficult to measure because membership is not recorded according to race. Estimates of membership in various plans range from 1 to 20 percent. All insurance plans, with the exception of two in the south, report that Negro physicians participate, if available, in surgical plans.

Cornely's figures indicate that four-fifths of the general hospitals in the north now offer patient care without racial distinction, but such integration applies in only 4 of 69 general hospitals in the south. A similar differential is found between special hospitals of the north and south. About 10 percent of the northern hospitals offer residencies to Negro physicians and 20 percent permit membership on the active staff. Staff privileges are somewhat more available in southern hospitals, where Negro physicians are expected to serve patients in segregated wards.

Services provided by health departments in the north are predominantly but not wholly integrated. Of 23 cities, 13 reported employment of Negro professionals in official health agencies. Of 8 southern cities, only 2 reported integrated services, and all employed Negro professionals.

Among 200 voluntary health organizations in the north, 1 out of 6 employ Negro professionals, and a similar proportion—but not the same organizations—have Negro board members. The proportion was somewhat higher in the south.

## Health Manpower Angles Explored by Panel

"Where do we get our manpower?" This basic question in providing adequate health services for America's millions produced a variety of answers from a public health panel.

Leroy E. Burney, M.D., Assistant Surgeon General, deputy chief of the Bureau of State Services, Public Health Service, said that while recruitment must be stepped up the energies of the professional public health worker must also be redirected in order to gain the fullest use of his service.

He suggested that the professional worker should rely to a much greater extent on the talents of the nontechnical members of the public health team.

"We have hardly begun to appreciate the major contributions that homemakers, nurse aides, practical nurses, business administrators, executive assistants, and sanitarians can make to public health," he said. "By delegating many of the daily operations not directly related to his professional skills, the highly trained worker will be able to devote a much larger part of his valuable time to problems requiring his special competence. Only in this way will the professional worker be able to meet the ever-increasing demands for his services."

## Trainee Selection

William C. Cottle, Ph.D., professor of education and assistant director of the guidance bureau, University of Kansas, believes that research into the traits of successful persons in public health occupations will yield material which can be utilized in schools and recruitment and improve staff productivity.

Efforts to date have been concentrated on telling people about, and selling them on, the advantages of careers in public health. Now we need to discover the kind of people who are and are not successful in the varied fields and the traits that make them successful, he said.

Cottle advocated the same scientific research approach to the selection of trainees in public health that are used in identifying, treating, or preventing an infectious disease or in solving any other major scientific problem.

"Before we can award scholarships and fellowships, we need to

know what kind of scholars and fellows we want," he explained. "The range of jobs in public health covers people with varied traits, and a person unsuited for one occupation in public health may have the aptitudes, abilities, and interests that fit him for success in another field of public health."

Cottle also suggested part-time employment of public health workers who become housewives.

Perry Sandell, M.P.H., director of the bureau of dental health education, American Dental Association, stated that future health manpower needs can be more definitely determined after we have been able to make the most effective use of health personnel now available.

"We hear repeatedly of the misuse and waste of the special skills of people engaged in public health work. Not only does this result in ineffective use of personnel, but often results in loss of health personnel because of job dissatisfaction," he said.

## On the Job Training

Ross Kandle, M.D., deputy commissioner of health of New York

City, advised that an active accredited residency in preventive medicine is essential in recruiting physicians. The New York State Department of Health, he said, has six young physicians in training for careers in public health.

Kandle also advocated advanced training and education on the job. Well-grounded sanitarians might go to night school in urban areas and with help from a health department become engineers, he pointed out. Nurses recruited at staff level can be helped to get basic training in public health if they and the agencies both believe that adequate training in public health nursing is worth while.

An attractive pension plan is vital in holding a staff, he said, and important in getting people who will have an opportunity to grow on the job.

Also discussed at the session was the Health Career Horizons project of the National Health Council, which is putting information on all health careers within the reach of the Nation's high school students and their parents, teachers, and counselors.

# World Health . . .

## Eradication of Malaria, A World Health Goal

Ever since the Interim Commission of the World Health Organization inherited certain malaria control programs from UNRRA in 1946, WHO has placed top priority on helping governments to initiate or expand malaria control programs in all countries in which the disease is a serious problem, declared Louis L. Williams, Jr., M.D., consultant to the Pan American Sanitary Bureau, WHO Regional Office for the Americas.

By the end of 1954, a dozen coun-

tries or territories had eradicated or almost eradicated malaria, and the various agencies assisting malaria control—WHO, UNICEF, and the USICA—now are recommending the abandonment by all countries concerned of the restricted idea of control in favor of intensified campaigns aimed at achieving complete eradication as soon as possible.

## Growth of the Idea of Eradication

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## *Growth of the Idea of Eradication*

To illustrate how the concept of eradication has developed, Williams reviewed briefly malaria control activities in the United States from the early years of this century to the

eradication campaign of the late 1940's.

Among control highlights were the extension to rural areas of methods of killing mosquito larvae through use of oil and wind blown paris green, the development of county-wide malaria programs accompanying the growth of rural county health departments, and drainage involving the digging of more than 60,000 miles of ditches, which Williams stated 'went a long way toward breaking the back of the malaria problem'. Intensified malaria control programs during World War II carried out by State and county health departments in cooperation with the Public Health Service, and aimed particularly at protecting Army training camps in the south, brought further progress in removing malaria as a health menace.

As a result, the concept and feasibility of eradication of malaria from the United States came to be accepted and in 1917 the Public Health Service requested an appropriation to help health departments continue and extend the wartime programs, and to include all areas in which malaria still existed. In 1915 this was termed the Extended Malaria Control Program, but in 1917 the funds were being appropriated unequivocally for malaria eradication as such.

### *DDT and Chemotherapy*

In 1946 DDT became available for malaria eradication in the United States and was also used overseas by the military. DDT as a residual spray is effective at low cost. It has led to eradication, but it has also led to a need to achieve eradication before resistance to DDT develops in the anophelous mosquitoes.

Williams called attention to another sting to the malariologists bow—chemotherapy. Antimalarial drugs such as chloroquin, primaquine and pyrimethamine attack the malaria plasmodium within the human body and prevent its development and transmission.

### *Global Eradication*

As programs become nationwide, he said, there is a need for their expansion into regional programs, a function of International agencies. In 1950 the Pan American Sanitary Bureau resolved upon a continental eradication program, and in 1954 the 11th Pan American Sanitary Conference decided to hasten this process by resolving that member governments should convert all control programs into eradication campaigns within the shortest possible time.

In 1955 the Eighth World Health Assembly requested governments throughout the world to intensify malaria control plans so that eradication may be achieved, and it authorized increased WHO assistance to governments. UNICEF appears willing to multiply by 4 or 5 times supplies to antimalarial activities where the goal is eradication.

At the end of 1954, the situation in five of WHO's regions was encouraging. In Africa great distances and depressed economies make eradication seem a utopian goal, although this need not be so if administrative obstacles are overcome. Williams outlined WHO functions, which include technical assistance and training in malaria control as a part of building strong national health departments, and which are supported by the knowledge of a worldwide panel of experts. Much of WHO's malaria activities are financed by United Nations technical assistance funds, and UNICEF provides large amounts of insecticides and equipment.

Throughout the world, excluding the Iron Curtain countries and most of Africa, some \$32 million is being expended this year in fighting malaria. WHO estimates that approximately doubling this amount could convert all control programs into eradication campaigns. As the campaign approaches its end, Williams concluded it is inevitable that more assistance will flow from the more fortunate nations to countries with low economic resources to enable

them to eradicate malaria and remove the hazard of reinfection. "When that time comes, the World Health Organization should have no difficulty in achieving the ideal objective of global malarial eradication," he said.

### **UNICEF Gives Top Priority To Malaria Eradication**

For the immediate future, the United Nations Children's Fund (UNICEF), like the World Health Organization, will give priority to malaria eradication, announced August R. Lindt, LL.D., minister plenipotentiary, permanent observer of Switzerland to the United Nations and member of the Executive Board, United Nations Children's Fund.

UNICEF's Executive Board, he stated, has endorsed increases in aid to governments wishing to intensify drives against malaria. At its September (1955) session, it approved assistance for eradication campaigns in El Salvador and Mexico. The allocation to Mexico—\$2,400,000 for the first 18 months of the government's 5 year campaign—is the largest single sum ever voted by the Fund. UNICEF aided malaria eradication campaigns are under way also in Haiti and in Trinidad and Tobago.

Trachoma and leprosy, both of which take a high toll of child health, are other diseases which promise to assume greater importance among UNICEF aided programs, Lindt said. WHO and UNICEF assisted efforts to combat these diseases, he pointed out, had to await the development of techniques which make possible relatively low cost and far reaching campaigns.

Explaining the role of UNICEF in world health activities, Lindt noted that its exclusive function is to provide aid for improving the welfare of children as the name implies, and that its aid is primarily in the form of supplies. Except in emergencies,

assisted countries match the dollar value of UNICEF aid. Over the years, he said, their average expenditure has been \$3 for every \$2 from UNICEF.

In all its work, Lindt stated, UNICEF relies on the Food and Agricultural Organization and the World Health Organization, which provide aid primarily in the form of technical assistance, for assurance that its policies and planning are based on sound technical ground. He called special attention to the WHO's division of maternal and child health, which works closely with UNICEF.

## Current Programs

This year UNICEF-aided disease control and nutrition campaigns are benefiting more than 32 million children and expectant and nursing mothers, Lindt reported. He mentioned the following specific UNICEF contributions: BCG vaccine, which is enabling WHO/UNICEF programs to vaccinate 14½ million children against tuberculosis; DDT, which is protecting other millions against malaria; penicillin, the sulfones, and other drugs, for use against yaws, leprosy, trachoma, and other diseases; and milk, which is the foundation for a multitude of child nutrition programs. Powdered milk, he noted, is donated to the Fund from United States' surplus supplies; the Fund pays only the cost of transportation.

Maternal and child health centers set up or improved with WHO/UNICEF aid number 5,000, he said. As an example of the results of this work, he gave the following data for West Bengal, India: In December 1953, when first shipments of UNICEF equipment for health centers were due, 6,700 children and mothers made first visits to maternal and child health centers in the area. In March 1955, 58,000 made first visits.

Help in developing facilities for improving local dairy industries and for the manufacture of other protein-rich, low-cost foods is another UNICEF activity, which is being conducted in cooperation with FAO,

according to Lindt. As examples of the latter, he mentioned a plant in Indonesia which will process a drink made of soybeans, peanuts, and malt and a fish flour production plant in Chile.

## NTA Director Considers World Control of TB

The elimination of all human infections caused by tubercle bacillus, the goal of tuberculosis control in the United States, can also be the world goal in tuberculosis control, maintained James E. Perkins, M.D., managing director, National Tuberculosis Association.

"I know of no valid reason why this goal may not be capable of fulfillment if one does not attempt to put a time limit of its achievement," he said.

Even in countries with an astonishingly high tuberculosis rate, areas of comparatively little or no infection can be found, he noted. Is it too much to hope that such areas can be enlarged gradually until finally the spots of high prevalence fade and disappear?

Particularly encouraging in accomplishing such a feat, Perkins felt, is the indication that, with new drugs, the expensive and slow step of hospitalization can be minimized. He emphasized, however, that he was not suggesting that hospitals are no longer necessary, and he pointed out that carefully controlled, extensive trials of drugs in outpatient treatment of tuberculosis are barely begun.

Perkins also is hopeful for the development of a completely acceptable vaccine suitable for universal application. This would be even more of a shortcut to the eventual eradication of tuberculosis, he said.

He is aware, he remarked, that some experienced epidemiologists consider such a goal unrealistic. They point to the fact that the tubercle bacillus is only one of many causes of tuberculous disease and therefore object to calling it the primary cause.

"But in the absence of the tubercle bacillus," Perkins pointed out, "there can be no tuberculosis regardless of the degree of malnutrition, mental trauma, poverty, overcrowding, war, or the multitude of other overlapping and ill-defined factors frequently associated with the development of tuberculous disease; furthermore, there seems little doubt that an individual will develop tuberculous disease if he receives a sufficiently heavy infection of tubercle bacillus regardless of his resistance. It therefore seems quite proper to refer to the bacillus as the primary cause and the other factors as secondary causes."

Perkins doubted that cyclic reductions and resurgence of tuberculosis are inevitable in the future, in view of the specific control measures now available.

## International Activities

According to Perkins' brief review of international activities, definite progress is being made in reducing the tuberculosis problem, but the progress is admittedly slow. WHO and UNICEF, he said, have almost necessarily limited their tuberculosis work largely to mass administration of BCG.

Dr. Chandra Mani, director of the WHO Regional Office for Southeast Asia, recently was reported to have said that the fight against tuberculosis, though intensified, is not even approaching the threshold of success in his area, Perkins stated. Dr. Mani stressed that, lacking any swifter and more potent weapon than the BCG vaccine, tuberculosis "will remain public health enemy No. 1 for some years to come," Perkins noted.

But WHO is exploring other solutions, Perkins said. More or less summing up the international situation in tuberculosis control are the following statements which he quoted from a *WHO Chronicle* review of the Director-General's annual report for 1954:

"... in countries where within 5 years the [tuberculosis] mortality has diminished by about half, the

number of reported cases of tuberculosis has dropped little, and the number of known infectious cases has sometimes even increased."

"... mortality figures can no longer be used as an index of the incidence of the disease... the prolongation of life in patients seriously afflicted with the infection may result in greater need for public health measures for their rehabilitation and assistance; and the epidemiological significance of widespread chemotherapy will have to be determined."

The review went on to say that "problems such as these are being given serious consideration by WHO. It is urgent, for example, to determine how effective ambulatory chemotherapy may be in areas where institutional facilities are not, and cannot be, adequate to meet the need for isolation and treatment."

## Improvement in Sanitation Faces Slow Going

From a global standpoint, no great change in sanitation practices may be expected in less than a generation, because they must depend primarily on the children and youth of today, stated Herman G. Balty, Sc.D., director of the division of environmental sanitation, World Health Organization.

Sanitary management of shelter, water resources, food service, wastes, and vectors is slow to improve, particularly in areas where its significance must be learned, habits changed, and facilities built and used, he pointed out. Within the next 5 years, however, he believes that all governments can accomplish the following basic things:

1. Recognize the real benefits of sanitation to the health and well-being of their people.
2. Establish a sanitation unit within the national health service and staff it with personnel competent to plan and direct all phases of work in this field.
3. Integrate sanitation with other public health undertakings.

4. Develop a long-range plan of sanitation for the country as a whole, into which projects and programs may be fitted logically as to time and place.

5. Realize that it is possible to do something helpful in environmental sanitation under any conditions and under any budget and that the simplest things are often the most important.

6. Select a point of beginning, always the most difficult step, and outline an orderly progression of work and objectives.

## An Urgent Necessity

Pointing out that an examination of the reasons for inaction and unsuccessful projects in sanitation is not only an instructive exercise but an urgent necessity if future planning is to be soundly based, Balty gave considerable attention to these aspects of international health work.

One reason for the slow development of sanitation programs in some areas, he said, is a lack of real understanding of the meaning and potential of sanitation. For example, the term is used sometimes to refer only to excreta disposal, he remarked.

In other areas, a sense of despair engendered by the sheer enormity of the task prevents action being started, he noted. Such an attitude, he said, is often heightened by fear of unknown and possibly high costs of necessary construction, and little or no effort is made to analyze the relative costs to local governments and to individuals.

Still another deterrent sometimes encountered is the expectation that, if action is delayed at local levels, sooner or later a higher level of government will accept responsibility and, in some magical way, do the work without cost to the community.

Reasons for unsuccessful projects, according to Balty, include these: no plan into which the project fitted logically as to time and place; lack of real integration of sanitation into the general health services of the country; inadequate attention to the education of the people expected to use the improved facilities or fail-

ure to enlist their active participation in construction and maintenance; lack of sufficient qualified personnel to carry out the various functions; absence of a fiscal plan for the upkeep of the project and its extension into a broader program.

## Positive Results

On the positive side, Balty noted that, under the stimulation and guidance of WHO and other international agencies, the member countries of WHO are showing a noticeable upsurge of interest in the improvement of sanitation, particularly in Southeast Asia and Latin America. He mentioned, for example, the sanitation programs in Ceylon, India, and Burma. He also mentioned that the Pan American Sanitary Bureau has recently been asked to supply engineers for sanitation work in Nicaragua, Venezuela, Colombia, Mexico, and Uruguay.

WHO, an association of states organized for cooperative effort, provides "an unparalleled opportunity for bringing knowledge, skill, experience, and means... to bear upon the forces of ignorance, apathy, poverty, and despair which have so long imposed a cruel burden," Balty concluded.

## WHO-Member Countries Relationship Defined

A pattern of give and take for the common good based on mutual respect, close and frequent contact, and cooperative effort characterizes the relationship between the World Health Organization and its 80 member nations, stated Henry van Zile Hyde, M.D., chief of the Division of International Health, Public Health Service, and United States member of the World Health Organization's Executive Board.

Through WHO, "the spirit and machinery of effective permanent relations between nations have been created in the field of health, and they are operating smoothly and well," he declared.



Twice a year, Hyde pointed out, the health authorities of the world set aside their own business and travel great distances to meet together to consider one another's problems. He was referring to the annual world health assemblies and the annual meetings of the WHO regional committees. The latter, he said, provide an opportunity for governments to talk with their neighbors about health problems of their neighborhood.

The technical personnel of the WHO staff are another contribution of the member countries. The member countries have been most generous in making available for WHO work many of their top public health leaders, even though they leave a vacuum in their own country's health work, Hyde said. The WHO staff, now numbering 1,307, is larger than that of any other agency within the framework of the United Nations except that of the United Nations itself.

## *The Receiving Side*

Discussing the receiving side of the relationship, Hyde noted that in the beginning member nations did not know what to expect or what to seek in the way of help from WHO. Some wanted supplies; others wanted money; and still others wanted technical advice and assistance. The last is what WHO had to offer, he said, and the product proved so good and was presented in such a spirit that all the nations rapidly recognized its value. A parade of requests which taxes not only the finances of WHO but also the intellectual capital available to it is the situation today.

There is no stigma attached to requesting aid from WHO, Hyde emphasized, and he pointed out that competent leadership requires a recognition of one's own limitations and the ability to find ways to compensate for them. The progressive and dynamic leaders of public health are therefore the very ones who have asked most frequently and fervently for help, he said.

Greatly strengthening the relationship between WHO and its mem-

ber countries, according to Hyde, has been the creation of regional offices covering several countries or the stationing of representatives in individual countries. Through these devices, WHO is in intimate daily contact with the ministers and directors of health, as well as with the entire health staff, of each country, he noted.

Hyde calls the trust and friendship developed among the health leaders of the world through WHO during its short history phenomenal. They carry over into the operating relations between WHO and the governments, he said, so that when WHO deals with governments, professional friends are dealing with professional friends.

## **Education Is Vital Factor To Health in Asia**

The high priority of health education is well recognized in many areas of the world which heretofore have been isolated from scientific progress, according to Jennelle Moorhead, M.S., a recent traveler to many Asian lands. Mrs. Moorhead is associate professor, general extension division, Oregon State System of Higher Education, Eugene, Oreg.

Successful introduction of sanitation procedures in the Far East and Middle East, Moorhead said, hinges on helping Asiatic people gain an understanding of the relationship of disease to water contaminated by indiscriminate disposal of human excreta.

"The preservation and acceptance of what we in the United States consider fundamental environmental sanitation concepts is not a simple matter in Asiatic countries," she said. "The educational problem for them is complicated almost beyond our understanding. The health concepts we have accepted and which should be taught may violate or challenge religions, cultural, or philosophical views. No matter how advantageous environmental sanitation and health education facts may

appear to those of us in Western civilization, if they are to be accepted . . . they will have to be related to the values and attitudes underlying the practices of each locality in each country. New ideas must be linked to traditional beliefs. They must not violate religious beliefs or folkways which vary from country to country and from village to village within countries."

Adult health education and school health education will need to proceed simultaneously to avoid alienating a child from his family and its cultural pattern, she believes. School health education has first to overcome the burden of illiteracy.

"I returned from my study trip with deep respect and admiration for the Asians who are attempting to solve their health and education problems and with an intense feeling of pride in the American educators and public health officials who are giving technical advice and assistance," Moorhead said.

The strong PTA movement in Japan and Turkey and the village development program in India and Pakistan are the most notable developments in the seven countries visited, she said in reporting the following.

### *Japan*

Japan's health and education programs show a strong degree of westernization. Health instruction is taught in secondary schools by teachers whose preparation included training in health education. School health services are provided by nurses and physicians employed by the public schools. City elementary schools have health rooms with dental chairs.

The health of Japanese children will be greatly influenced by their aggressive parent-teacher organization, whose membership of 13 million has been instrumental in teaching democratic procedures. This movement and similar organizations have been helped to function successfully by the Division of Social Education, which is part of village, city, and prefectural government structure.

## Thailand

Thailand's greatest needs are in environmental health, malaria control, medical care, medical education, and organization of health departments. Despite production of abundant food there is malnutrition. The use of eggs, chicken, fish, and unpolished rice in the diet must be encouraged. Food is served with no awareness of the germ theory of disease.

A division of school health and a division of health education in the Ministry of Public Health are developing a long-range health education program. The emphasis will be on production of a basic curriculum for teacher training, carefully related to Thai culture and community health problems. School sanitation surveys are to be scheduled. Thai schools must be open enough to allow free circulation of air, closed enough to keep out rain, and set high enough to allow water to flow under. Rural schools do not have a safe water supply or even the old-fashioned privy.

## India

Cementing all programs for the improvement of living in India and Pakistan is the village development program which involves 85 percent of the population. The village worker is the key person, trained to work with the village leaders. An allied development is the program of social education and instruction in village handicrafts so that young farmers are taught handicrafts that will produce income for their village.

Training is planned so that workers and the villagers advance in knowledge together. Both receive some rudimentary training in sanitation and some information on better agricultural methods. The village worker is oriented in basic techniques of village work as well.

The present major health focus is on environmental sanitation. One hundred programs encompassing 30,000 villagers are under way to construct 90,000 safe wells. Everyone who works on this program will be a potential health educator.

Cultural attitudes and costs complicate the building of toilet facilities. An oriental squat plate with a water seal that can be supplied at low cost by the government seems to be the answer for a latrine that meets sanitary and folkway requirements. The pride of ownership should increase its use.

## Pakistan

A visit to refugee camps in Pakistan and India helps one realize the magnitude of the problems created by partition of the countries in 1947.

Only 379 nurses were left when partition necessitated the departure of the non-Moslem nurses. Some 300 nurses have since been trained, but there is still only 1 nurse to 100,000 population.

Today there is a nursing council to promote the training of nurses. Two hundred health visitors have been trained in the four centers established for training in maternity and infant care.

In Karachi, where the first school physician in Pakistan was appointed in 1951, school health work will start in the secondary schools, where the enrollment is 25,000. Of 2,000 examined, 40 percent were healthy. Vision defects are frequent, however. Presently there is a vigorous campaign to vaccinate against smallpox. Some 5,000 are vaccinated each month. An inservice training program of teacher observation of the school child is to be inaugurated. The health habit card is to be developed.

## Iraq

In Basra the first local health department in Iraq will train personnel to staff local health departments when established. Formal training is provided for sanitarians, health educators, and health visitors. The equivalent of a high school education is required for health visitors who then receive a year's training in nursery care, sanitation, personal hygiene, and school and child health.

Health visitors will be used in stead of nurses. Girls shun nursing

as a profession because of the still strong moral feeling against women taking part in public life. Health visitors must always go in pairs since a lone girl never enters a strange home. Only a few girls have been persuaded to enter this urgently needed field.

School health education depends largely on the success of the plan to assign health visitors to each school to carry on many of the functions of a school nurse.

Health instruction in Basra's two secondary schools, one for boys and one for girls, relates largely to the structure and function of the human body. Some sex education is included. Special emphasis is placed on diseases of the eye, malaria, and venereal disease. All secondary teachers must take 3 years of hygiene. Health instruction is not well established on the elementary level.

## Lebanon

Lebanon epitomizes all of the school problems found in the other countries. Education is confronted with dual religious viewpoints (Moslem and Christian), dual educational philosophies (French, Lebanese and American-British), and dual education systems (government and private). Technical assistance has been limited to working with the public schools.

An important and popular school health project was instituted by the government in March 1953. Among other benefits, 150 public school teachers who had never attended any meetings of any kind during their career attended one of four regional school health conferences or a national conference held earlier.

The demonstration elementary school established outside Beirut in 1952 is the first in the Middle East in which both English speaking and Arabic speaking students are in attendance with equal privileges. A Lebanese nurse and a part time Lebanese pediatrician are employed. Each child has two physical examinations a year with followup home

visits. As a result of the home visits, some drastic changes in home sanitation and health consciousness have occurred.

## Turkey

The Turks have better sanitation and water supply than most Asiatic countries. In the public schools, routine immunization against smallpox, diphtheria, and typhoid fever are given by the Ministry of Health.

The Turkish Tuberculosis Association gives the BCG immunizations and does the followup in home calls. Health instruction and physical education are both required in the junior and senior high schools. The girls' junior high school in Istanbul is the first Turkish school to use the modern community-oriented project type of school program, which was brought about by their parent-teacher association.

More important, he said, was the opportunity to extend the benefits of laboratory services to all: to have less concern about how many tests were done and more concern about how many who needed such a test did not receive it; less concern with the number of negative and positive tests and more concern with the number of false negatives and false positives; less concern with the number of tests available and more concern with their actual use. The criterion of community need would apply, he said, whether to cytological screening for uterine cancer or to toxicological detection services for industrial employees.

# Laboratory Developments . . .

## Focus on Community, Laboratories Urged

Public health laboratories, which have set the pace for public health programs in the past, have an opportunity to call the turn again, to shift the plane of focus from the microbe and the individual patient to the community as a whole, said Edward G. McGavran, M.D., M.P.H., dean of the School of Public Health, University of North Carolina.

Such a shift will support the attack on heart disease, cancer, mental disease, accidents, alcoholism, allergy, diabetes, glaucoma, rheumatism, and arthritis. It would promote the psychological and physical health of the environment, for both young and aged. It would stress rehabilitation no less than prevention, he said.

## Changes in Practice

The present emphasis of public health laboratories on biological production and clinical examinations, he said, must be seen in historical perspective. The public health laboratories were born when clinical medicine shifted from the diagnosis of symptoms to the diagnosis of disease. As clinical science improved, and as investigations unfolded the complexities of the conflict among the forces of health and disease, at-

tention shifted from diagnosis of disease to diagnosis of man. The case of malaria or rheumatic fever, he said, became "an individual, a physical, emotional, and social entity." This shift was not one of function, service, or technique, but one of focus. Today, the focus is shifting again, he averred, to the scientific diagnosis and treatment of the community as an entity.

With such a shift in focus, the responsibility of the public health laboratory to the entire population implies certain specific changes in practice. Traditionally, public institutions provide for the needs of the people when private initiative is absent. As private enterprise grows to meet the need, public services are directed to other unmet needs. If it is not necessary for the health department to provide diagnostic services itself, it is still incumbent upon it to see that the private services provided are the best that can be supplied. If private laboratories are producing biologicals to meet the need, the public laboratory can then reduce its own output and give more attention to other community needs. Less time would then be given to direct laboratory service and more to supervision, licensing, consultation, and training to assure the excellence of laboratory services.

## Community Diagnosis

To maintain their traditional leadership in public health practice, McGavran said, directors and key personnel in laboratories must be prepared to serve as "the doctor of the body politic." It is not sufficient for them to be experts in laboratory science. Beyond that essential background, they must know their community, its organization and power structure, its epidemiology and physiology. They must share in community diagnosis and know the resources and contributions of others in the public health profession. In short, they should be concerned first with public health and second with the laboratory.

It is a need among all disciplines in public health, he stated, to show less concern with their individual background, schooling, training, or origins and to show more concern with the job and status of the public health profession as a whole. It will not be easy to recruit qualified personnel for public health practice unless there is appreciation of the concept of public health as a calling in itself, he said. This concept of public health he pictured as "a distinctive profession of co-equal people from different disciplinary backgrounds with a specific focus on the community."

Such a concept challenges the best minds of young people in all health professions, he said, because ad-

vances in community or public health in the next hundred years will compare with advances of the past century in clinical sciences. But he said the challenge could not be voiced until those now working in public health accept the concept that theirs is a distinctive profession with a distinctive body of knowledge and a distinctive competence.

In essence, he said, that concept results in fixing the plane of focus on the community and treating the "patient community" as the "patient individual" hopes to be treated by a physician.

## New Biochemical Methods Needed by Laboratories

The need for new biochemical techniques for diagnosis and investigation of diseases in possible emergencies as well as in normal circumstances was described by Gerald R. Cooper, M.D., Ph.D., chief, Hematology and Biochemistry Section, Communicable Disease Center, Public Health Service, Atlanta, Ga.

Needed particularly by the public health laboratory are specific and dependable diagnostic and screening tests for each disease, purified immunological and metabolic reagents for improvement of diagnostic tests, and methods for the detection of abnormal host resistance in communities. Other recommended fields of endeavor in biochemistry, he said, are standardization of, and training in, newly discovered tests and reference diagnosis in rare and exotic diseases.

Further studies of the biochemical nature of disease agents and of host reactions should lead to development of specific tests for all diseases, he said. He was of the opinion that rapid and specific identification of organisms might be accomplished by enzyme, fluorimetric, or infrared techniques, and that particular host reactions, especially metabolic, might be used to devise rapid diagnostic measures if such reactions could be determined.

Also, studies should be continued, he said, upon the biochemical reactions in diseases with altered or abnormal immune responses when no specific test is available to detect or to measure the pathology. Another test needed is one that can reveal sequelae or residual damage from diseases such as brucellosis and hepatitis.

He mentioned cat scratch fever, sarcoidosis, and amebiasis as examples of diseases for which dependable diagnostic and activity tests require purified antigenic material, particularly serologic and skin tests. If antigens, antibodies, and metabolic products could be isolated from impurities, many false test results could be prevented, he said.

Concerning the need for new means of detection and measurement of host resistance in communicable diseases, he called attention to the significance of gamma globulin. A high incidence of hypogammaglobulinemia in a population would indicate the possibility of abnormal spread of disease in epidemics and increase the extent of disaster under environmental stresses. This may be especially important in atomic bomb disasters, he said, explaining that both cellular and gamma globulin properties and content are altered by irradiation. Such alteration might make displaced persons abnormally susceptible to infectious agents.

Most pathologists have little time to train personnel and standardize performance of new biochemical tests. Cooper indicated that training such personnel and standardizing new tests, along with biochemical reference diagnosis in rare and exotic diseases, would represent a substantial contribution to laboratory medicine.

## New *C. diphtheriae* Test May Help Small Labs

A test tube method for the determination of *Corynebacterium diphtheriae* toxigenicity has recently

been developed. It may be suitable both for mass testing and for performance in small laboratories unable to keep animals for fresh serum, according to Richard V. Walker, M.P.H., and Margaret I. Beattie, Dr.P.H., M.A., of the University of California School of Public Health, Berkeley, Calif.

Though all in vitro tests for *C. diphtheriae* virulence utilize the same ingredients, this simplification of conventional techniques takes less time and requires less antitoxin, serum, agar base, and material to be tested than petri dish versions. They said its sensitivity and specificity respectively were 98.4 percent and 98.9 percent, as ascertained by testing 190 strains previously tried in vivo.

A minimum 1.25 flocculating units per milliliter of preformed toxin were detectable. All components, except a minute amount of fresh serum agar, may be stored for 2 weeks prior to use, and most of the serum needed may be commercially prepared.

Described as patterned after a modification of the Oudin method for the detection of antigen-antibody reactions in agar gels, the new method employs a small test tube containing two layers of ingredients. The top layer is 0.4 ml. of 20-percent, fresh, nonhemolyzed rabbit serum agar, into which reactants diffuse from an inoculum placed on its upper surface meniscus center and from the bottom layer. Five to six units of diphtheria antitoxin in 1.00 ml. of 20-percent normal rabbit or horse serum agar constitutes the bottom layer, and the inoculum consists of *C. diphtheriae* organisms of suspected toxigenicity.

If toxin is produced by these organisms, concentrations of toxin and antitoxin increase independently in the diffusion zone. A white disc of precipitate appears where the ratio of these concentrations first approximates an optimum for flocculation. The test is positive if this occurs within 48 hours after inoculation of the tube medium.

The inoculum is obtained by pushing the circular part of a bacteriological loop, bent to form a right angle with the shaft of the instrument, over the surface of Loeffler's medium cultures or from colonies on blood-tellurite agar plates. In the latter case, a wire inoculating needle with an almost 90° bend one-eighth of an inch from the tip is used.

Walker and Beattie found that the inoculation must be accomplished by touching without breaking the surface of the test medium. This technique, however, affords a thinner margin for error than analogous, streaking procedures in earlier test processes.

They also agreed other technical difficulties inherent in the test might be reduced by centrifuging constituents for clarity when necessary, by assuring the sterility of the antitoxin reservoir serum, and by retesting negative strains *in vivo*.

## New Techniques Step Up Smallpox Vaccine Output

Yields of avianized smallpox vaccine have been increased threefold and the processing time has been reduced by recent changes in production methods.

Reporting the new techniques were Philip J. Forsyth, M.A., and E. B. M. Cook, M.A., immunologists with the Texas State Department of Health, Austin.

Injection of the seed virus directly into the allantoic cavity of an embryonated egg through the air sac end produces vaccinal lesions that are scattered throughout the chorio-allantoic membrane, and the entire membrane can be harvested for vaccine use, they reported.

In the Reid method of creating a false air sac over the embryo and injecting the seed virus into the "dropped" area, only a small portion of the membrane, 20 by 30 mm., was infected and harvested.

The average amount of vaccine produced per egg inoculated by the

old method was 1.5 ml. By the allantoic cavity method, the average yield is 5.2 ml. of vaccine—an increase of from 60 to 200 individual vaccinations per egg, they said.

The allantoic inoculation process is also a time and work saver, they reported. Done quickly and easily with an automatic pipetting machine, it takes only 6 man-hours to inoculate 600 embryos compared to the 24 to 30 man-hours for the Reid method.

## Definitive Potency Test

Tying in with increased vaccine volume was a suggested method of measuring more accurately the potency of the harvested vaccine, thus allowing more definitive dilution at a considerable saving in the manufacture.

Egg titration, they said, provides an accurate measure of the number of infectious particles of virus present in a given lot of vaccine. Specially prepared and diluted vaccine material is inoculated onto the chorio-allantoic membrane of 11- to 12-day-old embryonated eggs by the triangular-flap method. After a 3-day incubation period, the infected portions of the membranes disclose large and easily counted pocks under a dissecting microscope. Each pock is assumed to be the result of the growth of one infectious particle of vaccinia virus. The average number of pocks present for each dilution inoculated is determined, and from these counts the number of infectious particles present, or the titer of the original material, is calculated.

With a vaccine of known and predictable strength, the vaccine pulp material can be diluted as required, they said. It is now common practice, they explained, to dilute all vaccine pulp 1:5, regardless of the actual virus titer. Under this arbitrary dilution method, much of the vaccine greatly exceeds the required strength or fails to pass the standard potency test and must be discarded.

In their experiments, Forsyth and Cook found that a virus concentra-

tion of 20 million infectious particles per milliliter of vaccine suspension, read by the egg titration method, was successful in every Force and Leake rabbit scarification test. The rabbit test is the established method of testing vaccine potency.

On the basis of egg titration results, they were able, in many instances, to dilute infected membrane up to 1:20 and thus increase the vaccine from twofold to fourfold.

The avianized vaccinia virus retains its stability equally well in dilute and in concentrated form, they found.

## Three Trichinosis Tests Are Rated in Study

The complement fixation and flocculation tests for trichinosis were found to give comparable and valuable results superior to the precipitin test, according to four members of New York City's Health Department.

Harold T. Fuerst, M.D., epidemiologist, Morris Greenberg, M.D., director, bureau of preventable disease, and Daniel Widelock, Ph.D., assistant director, and Annie E. Thomson, M.D., bacteriologist, bureau of laboratories, conducted the investigations.

The choice of either the complement fixation or flocculation test, or both in combination, may be based on individual considerations, they said, although the use of the two tests in combination does not generally increase diagnostic accuracy. However, they continued, when one test is doubtful, a positive or negative result with the other may aid in appraising the clinical findings.

## Study Conditions

During 1952 to 1954, concurrent determinations of complement fixation and flocculation tests for trichinosis were performed on 437 serum samples submitted from 243 persons with active trichinosis and on 425 serum samples from 343 persons with no clinical evidence of the disease. The presence or absence of trichino-

sis in the 586 persons was verified by epidemiological investigations, they explained.

Single serum samples submitted for routine tests for syphilis from 321 persons were also tested for trichinosis by the two tests as controls, they stated. No clinical or epidemiological investigation of this group was made, they said.

Among the 343 persons whose clinical diagnosis showed no infection, 69 percent of the complement fixation tests and 65 percent of the flocculation tests were persistently negative, they related. Of the 243 persons with trichinosis, 64 percent of the complement fixation tests and 59 percent of the flocculation tests gave tom-plus results. The differences between the tests were not statistically significant, they said.

Titers from plus-minus to three-plus inclusive, have little, if any, diagnostic significance. The percentage of such intermediate reactors was consistently greater with the flocculation test than with complement fixation, they reported.

Maximum reactivity with the two tests appeared at the fifth to sixth week after the onset of trichinosis. The specificity of either of the two tests was markedly better than for the precipitin test, they declared.

## Biological False Positives Found by New TPCF Test

A new test may soon provide State laboratories with a simple method for detecting biological false positive reactions in serum tests for syphilis, reported Harold J. Magnuson, M.D., M.P.H., chief, Operational Research Section, Venereal Disease Program, Public Health Service, and Joseph Portnoy, Ph.D., bacteriologist, Venereal Disease Experimental Laboratory, Chapel Hill, N.C. Magnuson and Portnoy believe that the new test "will be as helpful as any other single test procedure now available."

The new *Treponema pallidum* complement fixation test (TPCF) appar-

ently is as specific as the tests in general use, Magnuson and Portnoy stated. No single test technique will measure all of the antibodies of syphilis, they said, but one or more of the treponemal tests may reduce the margin of diagnostic error, even though they will never eliminate it.

The principle of the test, they said, is simple. Virulent *T. pallidum* is obtained from infected rabbit testes, and the treponemes are concentrated by differential centrifugation. The lipid fractions are removed by successive acetone and ether extractions, and the active proteinlike antigen is then removed from the dried treponemes by a 0.2 percent solution of sodium desoxycholate. The resultant antigen is used in a conventional complement fixation test similar to the fifth volume Kolmer technique.

### Test Sensitivity

In primary and secondary syphilis and in congenital syphilis, the TPCF test was more reactive than the *Treponema pallidum* immobilization (TPI) test; in syphilis of the central nervous system, the TPI test was more reactive than the TPCF test, and in latent and cardiovascular syphilis, the tests were about equally sensitive, Magnuson and Portnoy reported.

They said that, in 266 patients assumed to have biological false positive reactions, serologic tests for syphilis (STS), TPI, and TPCF tests agreed in only 33.5 percent of the cases, but the TPI and TPCF tests agreed in 94 percent. In 78 "definite" false positive reactors, TPI and TPCF tests agreed in 98.7 percent of the cases, and agreement between the two tests among 188 possible false positive reactors was 92 percent.

In untreated early syphilis, TPCF and STS results were somewhat parallel, in the later stages of the disease, the correlation between results of TPI and TPCF tests was much higher than between either treponemal test and STS, Magnuson and Portnoy stated. They emphasized, however, that neither treponemal

test measures reagin, so that correlation between TPCF and STS results is not due to reagin cross reactivity.

In treated early syphilis, the correlation between TPCF and TPI tests is somewhat greater than the correlation between the treponemal tests and STS. In treated late syphilis, agreement between the two treponemal tests was less satisfactory than in untreated late syphilis.

Magnuson and Portnoy reported that two manufacturers are beginning to produce TPCF antigen and that as soon as the antigen is more generally available, evaluation of the test will advance more rapidly.

In conclusion, they said that if the present trends of production continue, any well-run laboratory will be able to perform the TPCF test and that "the results should be highly useful to State laboratories and clinicians in helping to resolve some of the perplexing diagnostic problems that arise in the serodiagnosis of syphilis."

## Study Shows Reliability Of STS and TPI Tests

The reliability of standard serologic tests for syphilis (STS) and the value of the *Treponema pallidum* immobilization (TPI) test in so-called questionable cases of syphilis were confirmed by a study conducted at the University of Michigan Hospital.

The study and conclusions were reported by Elizabeth B. McDermott, Lenora B. Stewart, M.S., and Reuben L. Kahn, Sc.D., of the serologic laboratory, and Albert H. Wheeler, D.P.H., and Ella M. Brandon, A.B., of the TPI research laboratory, department of dermatology and syphilology, University Hospital, University of Michigan, Ann Arbor, Mich.

Various laboratory workers have reported that when clinical findings and STS results do not agree, as many as 40 percent of positive STS have been negative by the TPI test. These findings led to the belief that standard blood tests gave large num-

bers of false-positive results and hence were not reliable.

### Kahn vs. TPI Test

At the University Hospital, where the Kahn test is used routinely, TPI tests are done free of charge whenever they are requested by the physician, McDermott and her associates said. Between September 16, 1954, and July 1, 1955, requests were received for TPI tests in 78 of 31,545 cases on which Kahn tests had been done. The results of these tests were:

Kahn positive, TPI negative....	23
Kahn negative, TPI positive....	6
Inconclusive (TPI and Kahn)....	10
Agreement between Kahn and TPI tests.....	39

The 23 false-positive tests, 29 percent of the 78 tests performed, indicate that the TPI test is a valuable supplement to standard blood tests when clinical findings and standard blood tests disagree, the research group stated. However, these same 23 false-positive reactions represent only 0.07 percent of the 31,545 cases tested, which in turn indicates that the standard blood tests are highly reliable in routine medical practice. The six Kahn negative-TPI positive reports cannot all be considered as false negatives, they said, "in view of the persistent positivity of the TPI tests in long-standing, adequately treated cases."

### False Positives

There is a continuing need for watchfulness for false-positive reactions, they stated. Many false-positive reactors who have been under observation for a number of years have been diagnosed as either syphilitic or nonsyphilitic in the 6 years since the TPI test became available, and a decrease in the incidence of suspected false-positive serologic reactions may be expected from now on. However, the reduction in the prevalence of syphilis may be resulting in an apparent rise in positive blood test results in nonsyphilitic cases, they warned.

They also emphasized that false-positive reactions are false only in relation to syphilis. Such reactions may have clinical value in other diseases, particularly in the collagen diseases, such as disseminated lupus erythematosus, periarteritis nodosa, rheumatoid arthritis, and rheumatic fever, they concluded.

## Minnesota Study Compares Bacteria Count Methods

The standard plate count (SPC) is a more rigorous and discriminating bacteriological test for grading raw milk than either the direct mi-

croscopic count (DMC) or the laboratory pasteurized count (LPC), according to results of a study made in the Minneapolis-St. Paul milk shed.

James J. Jezeski, Ph.D., and J. C. Olson, Jr., Ph.D., associate professors of bacteriology, department of dairy husbandry, University of Minnesota, and W. C. Lawton, Ph.D., laboratory director, Minneapolis-St. Paul Quality Control Committee, reported on the comparative studies to determine whether the LPC alone could be used for grading raw milk.

On the basis of 7,949 milk samples from about 750 producers between

### Relative agreement between three grading methods in the detection of unsatisfactory milk samples, Minneapolis-St. Paul milk shed, June 1954-May 1955

Period	Number unsatisfactory by—	Detected by—			
		SPC <sup>2</sup>		LPC <sup>3</sup>	
		DMC <sup>1</sup>			
		Number	Percent	Number	Percent
June-August.....	123	113	92	32	26
September-November.....	53	49	92	4	7.6
December-February.....	37	24	65	4	11
March-May.....	85	60	71	19	22
12 months.....	298	246	83	59	20
		SPC <sup>2</sup>	DMC <sup>1</sup>	LPC <sup>3</sup>	
June-August.....	535	113	21	119	22
September-November.....	250	49	20	49	20
December-February.....	142	24	17	26	18
March-May.....	153	60	39	30	20
12 months.....	1,080	246	23	224	21
		LPC <sup>3</sup>	DMC <sup>1</sup>	SPC <sup>2</sup>	
June-August.....	190	32	17	119	63
September-November.....	91	4	4.4	49	54
December-February.....	50	4	8.0	26	52
March-May.....	95	19	20	30	32
12 months.....	426	59	14	224	53

<sup>1</sup> Direct microscopic count.

<sup>2</sup> Standard plate count.

<sup>3</sup> Laboratory pasteurized count.

June 1954 and May 1955 collected at monthly intervals, they reported the SPC at 200,000 bacteria per ml. detected 13.6 percent of the unsatisfactory samples, DMC at 200,000 per ml., 3.7 percent, and LPC at 30,000 per ml. detected 5.4 percent.

Of the 1,329 samples unsatisfactory by any one or the various combinations of methods, SPC detected 81 percent; DMC, 22 percent; and LPC, 32 percent. SPC provided the best detection of various types of unsatisfactory samples and was considered to be the only method which might be used as a sole grading test, they commented.

The relative agreement between the three methods and seasonal variations are shown in the table. Using the various paired combinations, the SPC-LPC combination missed 3.2 percent of the unsatisfactory samples, DMC-LPC missed 50 percent, and DMC-SPC missed 15 percent, they said.

### Methodology and Results

All tests and procedures followed the *Standard Methods for the Examination of Dairy Products*, 10th edition. Samples were taken directly from the weigh tank as the milk was received. DMC slides were counted with microscopes having a 500,000 factor, with 50 fields counted routinely.

Further detailed studies to confirm or refute the data from this study are needed, they declared. Serious consideration should be given to: (a) the true worth of the direct microscopic count; (b) the establishment of rigidly controlled studies to determine the efficiency of the laboratory pasteurized count in other milk sheds; (c) the question of whether a sole LPC grading program would result in a materially increased product quality, and (d) the question of whether an LPC grading program alone would impose unnecessary burdens on the producer.

Reducing the LPC grade level below 30,000 will result in the detection of more unsatisfactory SPC samples, but the LPC standard must

be reduced below 5,000 to detect about 50 percent of the unsatisfactory SPC samples, they asserted.

## Phosphate-Bearing Water No Obstacle to New Test

A method for determining fluoride concentrations ranging from 0.2 to 2.0 p.p.m. in water supplies containing phosphates up to 2.0 p.p.m. was reported by the laboratory services section of the Connecticut State Department of Health, Hartford.

According to Earle K. Borman, M.S., chief of the section, and chemists Barbara G. Lang, B.S., and Omer C. Sieverding, B.S., the Connecticut test has a higher degree of accuracy than older methods.

Another advantage over the Lamar test, most widely used in regulating fluoridation operations, is that minor variations in room temperature do not affect the rapid development of maximum color in the samples.

Although both tests are subject to interference from substances other than phosphates, the Lamar test, a modification of the zirconium-alizarin determination, is not sufficiently accurate, even after a single distillation of the sample, to permit reliable assay of fluoride concentrations which depart by more than 10 percent from 1 p.p.m. when phosphates are present. Furthermore,

any drop below 1.0 p.p.m. in fluoride content introduces additional errors in the Lamar test when the phosphate content is as high as 0.5 p.p.m.

The new test was described as based upon the titration of unbound thorium using chrome azurol S indicator. Five milliliters each of indicator and buffered thorium nitrate solution are added to a 50 ml. aliquot sample in a Nessler tube. The color so obtained is suitable for spectrophotometric determination of the aliquot. This is accomplished by comparing its transmission value at 595 m $\mu$  with those on a curve plotting such values for solutions of known fluoride concentrations ranging from 0.2 to 2.0 p.p.m.

The buffered thorium nitrate solution consists of 4.75 parts buffer solution and 0.25 parts thorium nitrate solution. The buffer solution is prepared by diluting 22.7 gm. mono-chloroacetic acid with 4.8 gm. sodium hydroxide to 1,000 ml. The thorium nitrate solution is 3.5000 gm. thorium nitrate tetrahydrate diluted to 500 ml. It was emphasized that the success of the test is contingent upon the precision attained in measuring this latter reagent. Thorium nitrate must remain in excess after reaction with the fluoride ion.

If a spectrophotometer is not available, aliquots may be compared on a color basis to freshly standardized knowns.

## Medical Economics . . .

### Improve Or Be Replaced Hospitals Advised

As chief of the Nation's largest municipal hospital system, Basil C. MacLean, M.D., commissioner of hospitals, New York City, advised voluntary hospitals that unless they improved their organizations and

public services they would be supplanted more and more by governmental institutions. Although he himself favors a continuing partnership of government with voluntary institutions, he said, the continuance of that partnership depends on fuller recognition by the voluntary institutions of their public obligations.



The budget of his own municipal department includes more than \$100 million annually for operating city institutions and \$20 million for the care of public charges in voluntary hospitals. In the past 20 years, the city contribution to voluntary hospitals for its "so-called" charges, he said, has increased from \$2.75 to \$14 a day, and there is pressure to raise the amount to approximate more nearly their ward costs of \$20 a day or more.

The "sagging economy" of the voluntary hospitals has been supported by the growth of the voluntary health insurance plans, he said, but it has not spared them from the necessity of seeking still further government aid. To warrant such support, with the passing of "the tin-cup method of meeting hospital deficits," he said that voluntary institutions will be obliged to operate in a businesslike way to provide health services at a reasonable cost.

### *A Public Voice*

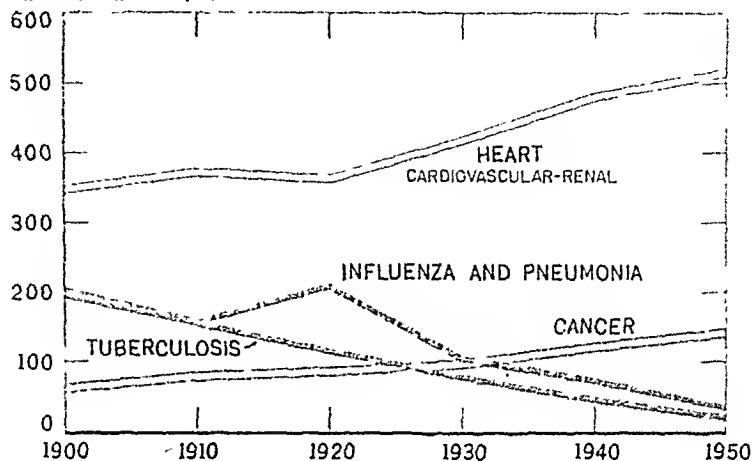
He challenged the notion that the tax-exempt status of the hospital derives from its "nonprofit" status rather than from the extent of community service offered. Considering that the public investment in hospitals amounts to more than \$50,000 for each licensed doctor in the United States, he questioned the right of the medical entrepreneur to set policies in voluntary hospitals without public interference and to deny the public a voice in determining prices and methods of payment of hospital services.

Admission policies also received heavy criticism from the commissioner. He charged that even when there is no question of compensation from the city or from insurance plans, the resident staff often rejects interesting and obscure cases in favor of more glamorous but simple surgical cases which assuage the "scalpel itch."

Multiple bills and fees associated with hospital services were compared by MacLean to the outmoded fashion of paying separate tuition fees to each professor in the medical

## CHRONIC DISEASES RISE INFECTIOUS DISEASES DECLINE

DEATHS PER 100,000



school. "Those who insist on a \$5 bill passing from the patient to a doctor for each urinalysis done by a technician," he said, "are pushing the public to demand governmental control." He said the public is disturbed by squabbles over what is and what is not hospital care and "by the confusion and cost of a system in which the doctor competes with the hospital for the patient's pocketbook."

"More and more," he asserted, "the question is being asked—whom does the voluntary hospital actually serve—the patient or doctor?"

### *Chronic Services*

To justify additional governmental help, he recommended that voluntary hospitals be willing to admit a fair load of medically indigent cases even if city subsidy does not meet the full cost. He said they must also give thought to establishing wings or annexes for chronic patients, including those with cancer and mental illness, with provisions not only for teaching material but for terminal cases. Otherwise, he warned, a further assumption of such responsibilities by government will ensue.

It makes more sense, he said, for cities to keep voluntary hospitals functioning effectively than to compete with them. "Government should step in only when voluntary effort fails," he said, "but it must be honest voluntary effort, dedicated to public service . . . and not controlled by predatory interests."

### *HIP Evaluates Its Services, Grades Quality of Care*

The scoring system developed in the HIP evaluation of group practice clearly identifies the physician who provides good medical care, according to Edwin F. Daily, M.D., and Mildred A. Morehead, M.D., M.P.H., vice-president and associate medical director, respectively, Health Insurance Plan of Greater New York.

To date, 18 of the 29 medical groups affiliated with HIP have been evaluated in the study, which began in 1954.

The HIP evaluation produces an objective evaluation of the management of selected cases of serious illness by an impartial review and dis-

cussion of clinical records, Daily and Morehead reported. Altogether, 80 percent of the plan's services will be assessed.

As a result of classifying group physicians according to average scores within the point ranges of 76-100 (good), 61-75 (adequate), 46-60 (below average), or 0-45 (poor), the services of some physicians with low ratings have been terminated, so effective is the index, Daily and Morehead also reported. They believe it can be adapted to other medical care plans.

### *Basic Factors*

The basic problem in methodology, the HIP officers explained, was to determine the type of material to be studied, the criteria for evaluation, the methods of recording information, and the relative weights to be given to the various factors. The cases selected for study are those in which the diagnosis on record at the central HIP office suggests the need for fairly extensive diagnostic work-up.

The evaluation encompasses a review of the clinical records in the departments of medicine, surgery, obstetrics-gynecology, and pediatrics within each medical group. Evaluation of radiology and pathology departments includes reviewing X-ray films and the group radiologist's reports and reviewing pathology charts and procedures as well as making control comparisons of specimens and tests. Study of preventive services is based on the presence or absence of expected preventive procedures.

A recognized specialist who is not affiliated with HIP visits the group physician's office, taking with him a list of the patients whose case management he intends to analyze. He reviews the clinical records, guided by criteria for evaluating the items to be rated, then rates and summarizes the handling of each case on a case work card. The possible ratings *a*, *b*, and *c* correspond to satisfactory, fair, and poor.

The interviewer credits the group physician for any information he may add during their subsequent discussion of each case, when the physician is also questioned about hospitalization policies, workloads, hours on call, and other factors influencing the operation of the group in which he practices.

### *Scores Averaged*

The clinical material obtained from the case studies and the interviewer's ratings are checked for accuracy, and numerical weights for scoring are assigned to the case work evaluations. The maximum possible score for the management of a single case, 100, is distributed among the three major areas studied for each case: 30 for the records section on the case card, 40 for diagnostic workup, 30 for treatment and follow-up.

At the conclusion of the study of each medical group, the scores are averaged, to obtain ratings for each physician, each department, and each group. Findings show that the averages of the scores provide an effective index for comparing medical groups and services. When the separate scores for any of the 16 items on the case card are averaged item-wise, they reveal areas of strength and weakness within the medical group. The range of scores for the cases of each physician is generally narrow.

The study does not end with the analysis of the scores. It continues with special presentations of findings at several evening sessions for all members of the medical group and with an intensive followup by a special team of consultants who advise the group's executive committee on how to carry out the specific recommendations of the medical team.

As a result of the study, many specific examples of improved methods of practice by individual physicians have been noted. Improved use of consultation and diagnostic services available in group practice have been repeatedly observed. A better understanding of the potentialities of

teamwork in group practice is also evident.

All recommendations concerning laboratory and X-ray departments, usually minor, have been promptly corrected. Rechecks of clinical records a few months after evaluation show much improvement. Chiefs of the various departments, some for the first time, have assumed full responsibility for directing the work of their associates and integrating their service with other departments.

The cost of the study has been about \$60,000 per year or about 15 cents per insured person. Future studies should take into consideration such factors as investigation of more cases of minor illness to determine if more serious illness existed, changes in scoring so that an unsatisfactory grade in one category would prevent full credit in the other two, direct observation of a physician's work, evaluation of doctor-patient relationships, and average time per office service.

## **Care of Long-Term Illness Will Require New Funds**

Adequate care of patients with chronic illnesses cannot be financed entirely from personal savings, nor will redistribution of existing funds for personal health services be sufficient to cover the cost of medical care for this group.

New money must be provided through higher insurance premiums from currently insured individuals, larger contributions by employers, and subsidies from various levels of government.

These were the points emphasized by Odin W. Anderson, Ph.D., research director, Health Information Foundation, New York, N. Y., in his discussion of the complex problems in financing long-term illness.

The recent increase in queries about the cost of treating diseases such as cancer and poliomyelitis seems to indicate that the problems accompanying them are becoming so

pressing that consideration is now being given to particular chronic diseases as well as to age groups and other special groups in the population, Anderson stated.

He based his discussion on the following assumptions and observations gleaned from the literature and recent conferences on chronic illness:

1. No family should be forced to reduce drastically its usual standard of living because of the cost of personal health services. Adequate insurance coverage should be available to self-sustaining families to meet such unpredictable costs.

2. At present families must be reduced to a subsistence level before they can benefit from tax-supported medical care programs. If a normally self-sustaining family above subsistence level is to remain self-sustaining, it must have access to adequate health insurance.

3. Long-term illness, a characteristic of the growing population over 50 years of age, has increased greatly during the past 50 years. Existing facilities, professional health personnel, and organization methods are not geared to the complex problems of long-term illness.

4. Similarly, except for certain illnesses such as tuberculosis and mental disease, existing methods of financing are not geared to the care of the patient with long-term illness.

5. Adequate services for the care of these patients cannot be financed from savings—liquid assets, personal property, and other personal effects—and from other assets which are regarded as the birthright of American citizens.

6. The prevailing benefits of voluntary health insurance today are hospital care and physicians' services in the hospital. For long-term illness, a broad range of services considerably beyond these benefits needs to be provided and financed.

7. Long-term illness is always expensive. The expense will be borne by the patient, his family, the insured group, or the total population through taxes.

8. Long-term illness involves loss of income if the wage earner is ill, expenditures for medical care, and additional expenditures for personal needs or services. Loss of income is proportionately a larger consideration in a long-term illness than in a short-term illness.

9. Because long-term illnesses have a relatively low incidence, it is more difficult to interest individuals in the need for insurance to cover costs of these expensive illnesses than in insurance for short-term illnesses.

10. Voluntary health insurance agencies are experimenting with major medical contracts to cover the costs of expensive illness, including long-term illness. Expansion of such contracts for employed persons can be expected to increase.

11. New mechanisms are needed and are being explored to underwrite adequate health insurance for usually ineligible, high-risk groups, such as the aged and the indigent.

12. New money will be required to finance adequate health services, and a redistribution of existing expenditures for personal health services will not be sufficient.

13. Therefore, higher premiums from currently insured persons, larger contributions from employers, and subsidies from various levels of government will be necessary.

14. During the next 10 years, major emphasis should be on increasing available finances for the care of patients with long-term illness. Reorganization of services may follow but will take longer. The amount and methods of financing and of organizing and providing services are directly related.

## Present Costs

Costs for medical care range from 0 to 50 percent of family income and average approximately 5 percent of family income, Anderson reported. The lower the income, the larger the percentage spent for personal health services, Anderson pointed out.

At present, the annual cost of personal health services averages \$207 per family, Anderson stated. Some costs for chronic illness are undoubtedly included in this figure, he said, although it is impossible to separate them from the total. However, 16 percent of the total costs for all families were in amounts of \$400 and over, distributed as follows:

<i>Medical costs in excess of—</i>	<i>Percent of families</i>
\$400-----	16
500-----	11
750-----	4
1,000-----	2

Distribution of the families whose expense for medical care exceeded \$1,000, by family income, was:

<i>Annual Income</i>	<i>Medical expense over \$1,000 (percent)</i>
Under \$2,000-----	1
\$2,000-3,499-----	1
3,500-4,999-----	2
5,000-7,499-----	2
7,500 and over-----	5

## Approaches to the Problem

Anderson discussed some possible approaches to the care of persons with long-term, costly illnesses. Among these were increasing the range of benefits in existing voluntary health insurance. At present, even the most comprehensive hospital and medical care plans do not provide home nursing service, convalescent home care, and appliances, he said. Also, with the possible exception of some major medical contracts, these plans frequently do not provide drugs.

If \$10 per family could be directed into health services, through health insurance or by some other means, it would mean \$500 million in new money for the care of patients with chronic illness; \$20 per family would increase the amount to \$1 billion, Anderson estimated.

We have a fair idea of the distribution of costs of personal health services among families of varying incomes in this country and of the proportions of these families whose

costs are above certain amounts, Anderson stated. However, he said that he had no way of knowing or estimating how much it would cost to provide the full range of services necessary to care for chronically ill persons if the funds and facilities were available to establish a full-scale program.

"Lack of experience inhibits action since financial considerations are a potent factor in trying new ventures; someone has to risk the capital," he concluded.

## Federal-State Aid Program For the Needy Reviewed

In a review of Federal participation in medical care for the needy, Charles I. Schottland, commissioner of Social Security, compared the volume of need with the amount of assistance given.

Of the nearly 5 million persons now benefiting from Federal financial aid to the States under the four assistance programs, a large proportion have an extraordinary volume of medical needs as a result of disability, chronic illness, or the infirmities of old age, he pointed out.

The estimated present medical care expenditures from Federal, State, and local funds total approximately \$265 million annually, or an average of about \$52 a year, for each assistance recipient in the four categories, he said.

For the average population, he reported, Blue Cross and Blue Shield insurance premiums covering hospitalization and in-hospital surgical and medical care would amount to at least \$100. And in 1954, each man, woman, and child accounted for \$63.25 worth of private medical care, excluding services paid from tax funds.

In describing the present formula for old-age assistance, aid to the blind, and aid to permanently and totally disabled persons, Schottland reminded that the maximum amount

in which the Federal Government may participate is set at \$55 per person a month for all needs. Within this maximum, the Federal share is four-fifths of the first \$25 and one-half of the remainder, or \$35 on the maximum. (The maximum in the aid to dependent children program varies with the size of the family.)

If a substantial medical cost is paid in any one month, the total of maintenance and medical care is likely to exceed \$55, with the result that Federal participation in medical care is very limited, he said.

He named as another problem the complex and relatively costly book-keeping operation in computing the Federal and State shares for each recipient.

## State Programs

In discussing the State programs, Schottland reported that an analysis of the situation in 48 States, the District of Columbia, Alaska, Hawaii, Puerto Rico, and the Virgin Islands reveals that 7 States make no payments for medical care under the four categories; 1 State provides this care through its public health department; and in the remaining 45 States the average annual expenditure per person receiving assistance is under \$24 for 20 States; \$24-\$71.99 for 15; and \$72 or more for 10 States.

Each State determines what items are necessary and how much will be paid for them, Schottland reported. Most of the States have limitations on the kind or amount of medical care provided from assistance funds. Some States make no provision for hospital or nursing home care; others provide only for hospitalization and drugs. One State provides dentures only to employable persons. In a number of States the funds allowed for dental care or for glasses or appliances that might help rehabilitate the recipient are severely limited. Still others limit the number of doctors' calls that will be paid for or the total amount allowed for medical care.

A number of proposals, he said, have been advanced from time to time to encourage and assist in the provision of adequate medical care by empowering separate matching of medical care expenditures.

## Practicable Hospital Data Goal of New Audit Plan

A new medical audit method for assessing hospital services has emerged from the research work of the American College of Surgeons and the Professional Activity Study of the Southwestern Michigan Hospital Council.

Paul R. Hawley, M.D., director of the American College of Surgeons, reported that the new approach has proved effective, practicable, and inexpensive in intensive testing at 23 hospitals in 21 communities in 3 States.

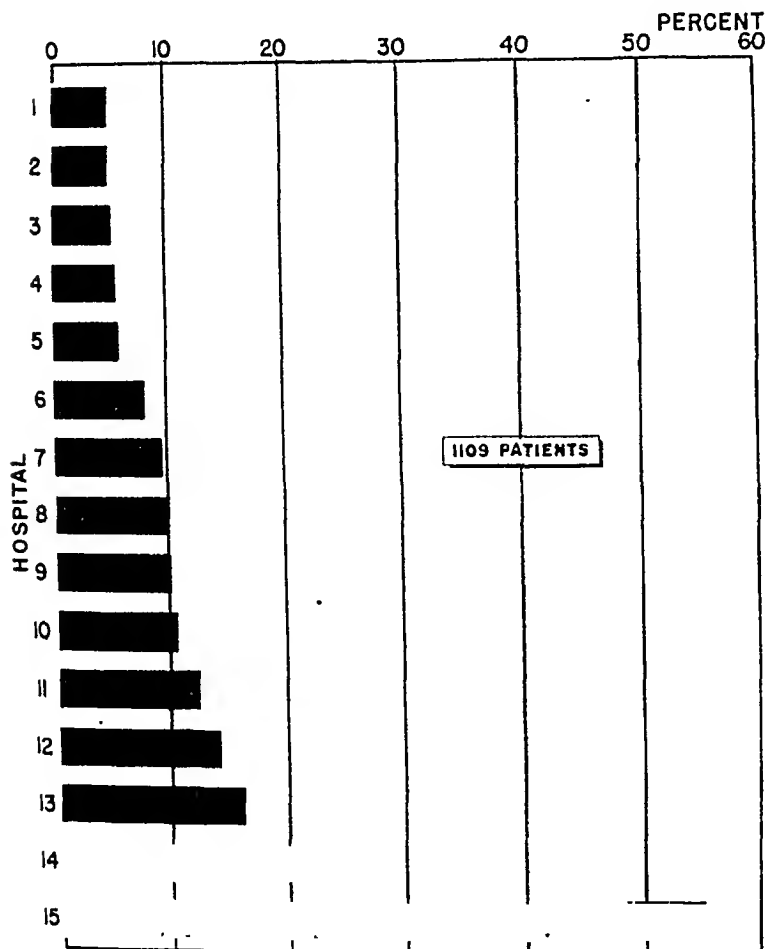
He named as deficiencies in past medical audits: use of nonvalid statistics, such as the discharge conditions of "recovered" and "improved"; surveys of limited and non-conclusive criteria, such as infections and deaths; impracticable methods of collecting, tabulating, and analyzing the data selected; and demands for excessive participation by busy practicing physicians.

In a civilization noted for its ability to enumerate the yearly production of automobiles, cans of soup, and bars of soap, we have no exact statistical information about such fundamentals as the number of appendectomies performed or the number of pneumonia patients treated in our hospitals each year. Hawley said.

## The Procedure

Basic to the new system are useful data standardized to permit comparison among hospitals of like size and patient groups, machine tabulation and analysis by a regional statistical service, and hospital medical staff evaluation.

Diabetes patients without blood sugar determinations.



From the hospital's medical records on discharged patients, the record room librarian transfers to a code sheet the data selected for analysis and comparison. Entered are such facts as the patient's age and sex, patient's physician, final diagnosis, operations, and laboratory procedures. For instance, if a blood count was done, this fact is recorded on the code sheet. If a chest X-ray or urinalysis was not made, this fact is recorded. The medical room librarian has no further responsibility for indexing and statistical presentation.

The code sheets go to a regional statistical service center where the

data are put on punchcards and machine tabulated. Five different kinds of lists are run off, breaking the data down by diagnosis, operation, physician, surgeon, and clinical service. The lists are returned to the individual hospitals and provide the medical record indexes necessary for accreditation.

With the data of all the participating hospitals retained on punchcards, the center can produce analytical comparisons in any specified phase.

Comparative analysis of medical care for the same disease gives the individual hospital a yardstick for measuring its practices and, if the pattern of care varies widely from

the other hospitals, the opportunity to determine the reasons, Hawley said. Medical staff evaluation of selected phases of patient care, he indicated, permits an effective and timesaving spot check by physicians.

### The Result

He drew several sample evaluation situations from the trial test results. One was the varying practice among 15 community hospitals of making blood sugar determinations on diabetes patients (see chart). Each of the hospitals had adequate laboratory facilities and were in an area noted for above average medical care. But in 8 of these hospitals at least 10 percent of the patients with recorded diabetes received no blood sugar determinations during their hospital stay.

The medical staffs of these hospitals, he commented, would certainly be interested in ascertaining the reasons for failure to use such a recognized, established, and authoritative test in the diagnosis and treatment of diabetes.

Hawley concluded that the presentation of statistical evidence on hospital services and experience emphasizes facts missed entirely by methods of evaluation that fail to tabulate, analyze, and compare practices.

### Metropolis O. K.'s Care But Not Way It's Given

The people of "Metropolis" tend to be satisfied with what they get in the way of medical care and to accept its cost, but they dislike the impersonality with which it is given, according to Earl Lomon Koos, Ph.D., professor of social welfare, Florida State University.

That modern, technique-centered medical practice lacks the human warmth of the old-time general practitioner was the view of 64 percent of 1,000 families, he stated.

Families in which husbands were under 40 years of age were more defi-

nite in their criticism than were families in which husbands were older. This finding, Koos said, disagrees with the charge that this attitude exists only among the older age groups, who view the passing of the family doctor with nostalgia.

Only 19 percent of the families believed that medical care was too expensive, and only 17 percent expressed pronounced dissatisfaction with the care available or received.

Koos described "Metropolis" as a somewhat sophisticated city of about 350,000 population located in the industrial northeastern United States. It has a medical school, a half dozen approved hospitals, a full complement of medical specialists, a sprinkling of general practitioners, and an "above average" health department. It may not be entirely representative of cities of its size, but it is probably nearly so, Koos said.

The families interviewed were an economically stratified but randomly selected sample. Data were analyzed on the basis of the family's membership in 1 of 3 social strata.

It is futile to belabor the physicians of "Metropolis" for they are often caught in a social matrix not of their own making, Koos said. However, it should not be futile, he added, to suggest that the individual physician alter his techniques and attitudes, insofar as possible, to provide what the people feel they need and want from medical care.

### *Hospital Care*

A somewhat similar but less specific criticism was made against hospital care, Koos indicated. Seventy-one percent of the respondents believed that the hospital care available to them was unsatisfactory, but most of them were not quite sure why. Koos said the following excerpt from one interview was characteristic of the replies of 8 out of 10 of those dissatisfied:

"I don't say our hospitals don't turn you out alive . . . but the way they treat you while you are in their

hands is pitiful. . . . I can't put my finger on it exactly. I think what I'm trying to say is nobody just gave a darn about me as a person. I was just somebody filling a bed."

Koos believes this situation is the result of the hospitals' changing social structure. The replacement of the relatively simple hierarchy of doctor-nurse-orderly-kitchen maid with a structure which includes various aides, technicians, floor clerks, and so on has created confusion and frustration for the patient and his family, he said.

Eighty-two percent of the families also believed that hospital costs were too high.

It must be admitted that the hospital, like the physician, is caught in the coils of an advancing medical technology, as well as faced with problems of labor and economics, Koos noted. He believes, however, that many of the ills current in hospital-patient-family relations are present simply because the patient has been somewhat forgotten.

### *Public Health*

The health department was viewed as a sort of health police force, Koos reported. Such functions as "keeping the water pure," "being sure that sewage is taken care of," "quarantining people who have infected [sic] diseases," "being sure that the restaurants are clean," were considered the only functions of the health department by two-thirds of the families.

There was little consciousness of the health department's value, its effectiveness, or even its real functions, he declared.

Koos suggested that one answer to why community health programs have not progressed more rapidly may be found in these data. If the population of a sophisticated urban community of better than average economic status lacks knowledge and appreciation of its health department's activities, we may well expect a similar or even greater lack in less-advantaged communities, he said.

When asked to suggest health needs not now being met that might be met through health department activities, only 2 to 3 percent gave fruitful answers.

The results of this study, according to Koos, suggest either a magnificent complacency about the health of the community, or an acute unawareness of what the term "health" really means, or an unawareness of what public health personnel have to offer. He believes that any of the three explanations gives cause to be disturbed.

### **Saskatchewan's Experience With Prepaid Care**

In Saskatchewan, Canada, three separate patterns of prepaid medical care have evolved over the past 35 years. The strengths and weaknesses of each in meeting the problems of rural medical care and possible further developments were discussed by Milton I. Roemer, M.D., M.P.H., director of the medical and hospital services branch, Saskatchewan Department of Public Health, Regina, Canada.

The first pattern was the municipal doctor plan, according to Roemer. Although varying in detail in different municipalities, the plan is essentially this: In return for a salary, paid from local tax funds (in later years, supplemented by provincial grants), a physician provides medical services to any resident of the municipality needing them.

Developed entirely through local initiative, the municipal doctor plans are the prairie settlers' answer to the problem of attracting and holding physicians in rural communities, he stated. And to this end, he specified, they have been effective. By 1950, the peak year, there were 173 municipal plans in operation, covering at least 200,000 of the Province's 833,000 population.

These plans, however, have not been able to keep pace with changes in social and living conditions or in

the practice of medicine, Roemer maintained. The inability of an isolated general practitioner to practice the best modern medicine he considers the most serious limitation.

Neither the quality nor the quantity of services provided under the municipal doctor plans can be a cause for deep satisfaction, he said. Concerning quantity, he mentioned that in one plan the volume of services in 1951 was 1,883 per 1,000 persons. In this plan, there were 2 physicians practicing full time and 3 who were semiretired, serving 3,000 persons. He compared the figure to the 4,405 services per 1,000 persons provided in the same year under the regional medical care program in the Swift Current public health region, where there were 36 physicians for a population of about 50,000.

## Voluntary Plans

Voluntary prepayment plans sponsored by the physicians themselves was the second of the patterns. Begun in 1939 in the cities of Saskatoon and Regina, where local governmental prepayment plans did not exist, they began to expand rapidly about 1950, Roemer said. In that year, the Saskatoon plan began to seek voluntary enrollments in rural communities, and by 1955, it had enrolled at least 75 percent of the population in each of 18 towns and villages and 58 rural municipalities (75 percent was the minimum to qualify for inclusion in the plan).

Membership charges are much higher than the taxes under the municipal doctor plans, but the voluntary plans have the advantage of free choice of almost any general practitioner, including those under municipal contract, and any specialist in the Province, he pointed out. Prosperity, improvement in roads, increase in the number of automobiles, and popular writing about modern medicine, he indicated, have helped to provide a favorable climate in the rural areas for the growth of the voluntary plans.

In 1955, Roemer stated, the average annual cost of the Saskatoon

community plans was \$18.50 per capita, with a usual family charge of \$72. Also, to reduce expenditures, it has been necessary to introduce restrictions—for example, a \$600 limit on services to an individual in any one year for any one illness; a \$25-a-year limit on diagnostic X-ray and laboratory examinations; no care for allergic or psychiatric conditions. Another weakness, Roemer said, is the fact that 25 percent of the population is not covered and that these largely represent low-income families in special need of medical care.

## Regional Plans

Another possible solution to the difficulties in providing rural medical care was recognized in 1945, when a prepaid medical care plan was organized in the Swift Current public health region, Roemer stated. All 36 physicians in the area participate in the plan, so there is a free choice of many physicians, and all 50,000 residents of the region are entitled to services. It has been possible, he reported, to provide "quite comprehensive medical services at an annual cost of about \$14 per capita."

The quantity of medical services is considerably higher than under the municipal schemes, and the quality is doubtless as good as under the voluntary schemes, he maintained. Another good feature is the encouragement of preventive services.

However, Roemer does not consider the regional plan completely satisfactory. He noted, for one thing, that the people still must rely heavily on general practitioners even for relatively complex procedures. Only on a provincewide basis could the people have access to all medical skills, he said.

Roemer observed that from the use of all 3 plans it could be said that in Saskatchewan's experience with prepaid care hospital admissions are increased rather than reduced. In rural areas without prepayment plans, the admission rate was 197 per 1,000 in 1954 as compared to the 260 admissions per 1,000 persons per year in the Swift Current plan region.

"Whatever benefits may derive from early diagnosis under prepayment, the very access to a doctor evidently results in case finding and hospital therapy to an extent which causes overall increases in hospital utilization," he remarked. He estimates that, in its varied forms, prepayment now covers 45 percent of Saskatchewan's population.

Efforts to launch new regional schemes within the last year have been unsuccessful. Plebiscites on new taxes to support the plans decided against them, he reported. Roemer believes, however, that negotiations with the medical profession, which has recently come forward with a new prepayment plan, should ultimately result in a mutually agreeable regional plan.

But still other steps are necessary for improved rural medicine, Roemer declared. "The challenge is to provide a general medical practitioner close to the people, yet working in a framework which would permit him—without financial loss—to refer cases readily to a specialist's care."

To achieve this objective, Roemer suggested that rural general practitioners might be attached to medical groups, with a group clinic located in a large town. The village physicians could refer difficult cases to the clinic, and major surgery could be done in district hospitals, he said. The village physicians would share in the income earned by the group as a whole.

## Saskatchewan Shares Prepaid Plan Data

How statistical data derived from prepaid hospital and medical care programs are used for knitting Saskatchewan's health services into a comprehensive and balanced unit was described by Murray S. Acker, M.D., D.P.H., and L. G. Williams, M.A., of the Saskatchewan Department of Public Health, Regina, Canada.

Public health and medical or hospital care agencies are continually

designing records and collecting data, and often no one seems to know how all of this interesting information can be put to use, they said. All the data may not be relevant to the immediate tasks of an agency. But many times they could be of inestimable practical value to another agency operating in a different sphere of health activity if there were some mechanism for sharing the information, they explained.

Saskatchewan, they acknowledged, has the mechanism and a more than customary motivation for achieving coordination of services. Although diverse in coverage, benefits, and maturation, the existing provincial, regional, and local programs are predominantly tax-supported and publicly controlled, and they are directly or indirectly supervised by the provincial health department.

In their advance along parallel fronts toward a universal, comprehensive service, coordination is mandatory to avoid serious contradictions and inequities, they said.

Contributing data with the widest application, they reported, are the provincewide hospital care insurance plan with eligibility for benefits contingent upon prepayment of a tax premium; the Swift Current region-wide prepaid medical care program covering every resident with a wide range of benefits on a tax-supported basis; and the provincewide public assistance program providing a virtually complete range of health benefits to the indigent and near indigent.

These data are timely and reasonably accurate, they said. Moreover they are referable to the total population in the Province, or in a geographic region, or within a specific socioeconomic group.

Acker and Williams pointed out that within Saskatchewan's organizational framework any parallel agency, inside or outside the health department, has ready access to the statistical data of the operating prepayment programs, and thus the data are of potential value beyond their requirement for the immediate

administrative functions of the prepayment agency.

Initial steps have been taken to use the data for planning specific public health projects, they said. Decisions requiring the extension of medical care benefits have been guided by precise measures of morbidity.

Analyses of hospital care data have been valuable in formulating indexes of bed need in specific areas and in stimulating higher standards of care. The data have supplied material for epidemiological studies and for public and professional education.

### *In Health Project*

Illustrating the use of prepayment plan data in deciding policy and planning a public health project was an account of the organization of a regional program for rheumatic fever prophylaxis.

Hospital caseload and cost data demonstrated that a successful preventive program, using daily oral penicillin at an average annual cost of less than \$40 per capita, would in time realize substantial savings in hospital care costs in a public program. The \$52 hospital discharges for rheumatic fever and the 385 discharges for chronic rheumatic heart disease in the typical year of 1952 accounted for 25,585 patient-days of hospital care at a cost of almost \$210,000. Medical care costs added a further estimated \$52,000.

After the program started, the hospital records solved the problem of case finding in the region. Lists of the 106 regional patients hospitalized with rheumatic fever over a 5-year period, plus relevant data such as age, residence, attending physician, and hospital, gave the officer immediate information on the majority of potential candidates for prophylaxis.

Another example illustrated how universal insurance plan data can fill in the gaps and delays inherent in compulsory reporting of notifiable diseases. The Swift Current medical care plan yielded early information on primary cases of infectious hepatitis during an upswing of incidence in the region. The knowl-

edge, gained from the daily medical account forms of the practicing physicians, facilitated the widespread administration of gamma globulin in the prevention of secondary cases.

### *Use Pattern*

In the hospital program itself, the operations data have proved valuable adjuncts in studying such factors as variations in the patterns of use, they reported.

They gave as one example the higher rate of use in rural than in urban areas revealed by the service statistics. Characteristics of the areas of highest use, a study found, were greater rurality, low population density, larger families, lower land values, and greater distances from large cities.

Inadequate resources for home care and a smaller supply of physicians, it was concluded, figured in the high use rate.

In the rural "high" areas patients with influenza, pneumonia, and bronchitis were admitted 4 to 6 times as frequently as similar patients in the urban low areas of use. Though admitted less frequently, the urban patients with respiratory illnesses had longer periods of stay. In other words, they said, less seriously ill cases in the larger urban centers were much more likely to be cared for at home.

By these analyses, they said, high utilization is more intelligently understood as a combined product of social, geographic, and professional conditions than the result of personal whim on the part of the patient and his doctor.

### **Indigent Medical Care Plan Operated by Physicians**

The key to the success of the Topeka plan for providing medical care for the indigent is its operation by local members of the medical profession, in the opinion of Glen C. James, director, Shawnee County (Kansas) Social Welfare Department.



Now in its 13th year, the plan has received nationwide attention and the "seal of approval" of the American Medical Association, James stated. He outlined the plan's main features as follows:

By monthly contract, the public welfare board employs the county medical society to obtain complete medical services, hospital care, and drugs for patients referred from the county's public welfare rolls. The board agrees to pay the society a lump sum, based on a fixed amount for each person sharing in the benefits of a public assistance grant. (Until July 1953, the payment was on a family unit basis.) As agent of the welfare board, the society then asks all its member physicians, 102 in number, to give professional services to referred welfare recipients.

The plan is primarily clinical in nature, with 17 well-equipped clinics staffed by physicians of the society on a rotation basis. However, both day and night house calls are made, and diagnosis and treatment may be given in a physician's office at the physician's request. Hospital care is authorized by the attending physician and paid for by the society. Prescribed drugs are dispensed at the medical society drug store during the day, or, if dispensed elsewhere after clinic hours, they are paid for by the society.

The physicians are paid by the society on a unit of work basis, according to a set schedule: An office or clinic visit is 1 unit; a day home visit, 3 units; a night call, 5 units; an obstetrical case, 20 units; and major surgery, 35 units. The cash value of the unit varies, since the funds remaining each month after all outstanding bills have been paid are prorated among the physicians on the basis of the number of units of work done.

The welfare clinics are staffed with nurses and clerical personnel employed by the local public health department, which is located in the same building. The clinics and the

health department also use the same laboratories.

## *A Minimum of Problems*

Problems in connection with this medical care program are held to a minimum, according to the welfare director, by the extensive use of committees that hear complaints and work out necessary changes: a committee on hospitalization, a consultation committee, a clinic committee, a drug committee, a complaint committee, and a finance committee.

Among the problems he mentioned is "the often legitimate gripe of the physicians that persons demand excessive services just because there is no extra charge for extra services." Another is the fear on the part of the patients that public medical care will be inferior to private medical care.

To help make the plan function smoothly, there are a few restrictions, James said. For example, the attending physician may not hospitalize a patient for longer than 2 weeks without the consent of the hospitalization committee; new drugs cannot be used until the drug committee adds them to the available list.

Recently, the medical society and the welfare board agreed to permit the physicians to charge patients \$1 for each house or office call, the charges limited to two a month, James reported. The practice was abandoned after 3 months' trial on the suggestion of the physicians, who found that it was "both unpopular and unprofitable."

## **Samples Union Opinion Of Group Care Plan**

A study on how the patient-members felt about the Labor Health Institute of St. Louis, Mo., a prepaid union group medical and dental plan, was reported by Nathan Simon, M.D., and Sanford Rabushka, M.D., interns at Jewish Hospital in St. Louis.

The institute is one of the oldest and most successful comprehensive, prepayment group practice plans, they said. Founded in 1945 by what is now the Warehouse and Distribution Workers' Union, AFL, the institute provides comprehensive medical and dental care to 15,000 union members and their families, a low-income group of semiskilled and unskilled warehouse workers, they reported.

The institute's complete dental program makes it unique among plans of its type in the United States, they declared.

Financing is by employer contributions of 5 percent of the gross payroll in most of the firms covered and provides protection for the union member, spouse, and all children under 18, they reported. In a few shops the employer's contribution is 3½ percent of gross payroll and covers only the union member, they added.

## *Findings*

On the basis of a sample of 199 of 15,000 members they found that:

Sixty-five percent expressed unqualified approval, 21 percent were satisfied but had some criticism, 7 percent had no opinion, and 7 percent expressed marked dislike of the plan.

The dislike was correlated with dissatisfaction with the patient-doctor relationship. It appeared that people who disliked the plan entered it with preconceived ideas which precluded their acceptance of the plan.

Members who used the institute found the quality of professional care satisfactory and were able to establish stable doctor-patient relationships the same as before joining the plan.

The institute provided about 80 percent of the total professional services of the sample for the year studied. The most frequent reason for using outside services was a strong attachment to a physician or dentist not on the staff of the institute.

# Service Statistics . . .

## Sound Service Statistics Measure Achievement

Sound service statistics are essential in maintaining or redesigning the original plan of the public health program as it progresses, stated Evelyn Flook, chief, Public Health Practice Studies, Division of General Health Services, Public Health Service.

The Working Group on Service Statistics of the Public Health Conference on Records and Statistics, the National Conference on Evaluation in Public Health, and the Committee on School Health Service Statistics of the American Public Health Association are promoting the concept of sound service statistics for program management. The working group has defined service statistics as meaningful numerical measurements of services rendered to individuals and to the community through public health programs.

Statistics which focus attention on numbers and kinds of persons served, types and amount of service rendered, and what happened as a result of the service are not to be confused with traditional activity counts, Flook said. True measurements of accomplishment cannot be arrived at by counting units of service alone, she said.

Sound service statistics can provide perspective for judging success or failure in achieving stated objectives or in making progress toward them, she continued, adding that service statistics can serve as the gauge for distributing or redistributing resources and for determining whether and when program operations should be realigned.

### Useful Data

Flook said that the factor of interrelatedness was more important than any other in the development of sound service statistics. Case rec-

ords of individuals served by the health department are an excellent source of data, she noted. She continued:

"The units of measurement which apply to service rendered must be related to such baseline data as population, by age groups; morbidity, natality, and mortality; the health needs of special groups—not as seen by the public health worker alone but as also seen by the people; health facilities, services, and personnel available under public, voluntary, and private auspices; housing, sanitation, nutritional and general economic status of the community; and information reflecting expenditures."

In addition to being related to baseline data in establishing quantitative relationships between the service rendered and the health problems involved, service statistics, to be most useful, should:

- Be designed to serve a specific purpose, such as help define a health problem, help measure extent of service, help measure progress in relation to the problem, help furnish a basis for future planning.
- Be developed in accordance with clearly defined program objectives.
- Reflect service to people—not

merely enumerate volume of activity of the health department staff.

- Be sufficiently limited in scope and volume to justify the time, effort, and expense involved in production.

Preparation of recurrent statistical reports can be simplified by making special limited studies in place of routine collection of complex mass data, Flook added. Short-term studies, often based on a sample of the total and aimed at answering specific questions, are economical. Frequently, they pinpoint the particular problem at issue, she said. Well-controlled epidemiological studies, with appropriate appraisal of differences in effect, are classic examples of the use of service statistics which show the population affected and that unaffected by a particular problem, she remarked.

Flook then outlined how useful statistics might shape up for evaluation of programs. For a single segment of a school health program, they might include:

- The school population covered.
- Number of children examined.
- Number of children not examined who should have been.
- Number of children with health needs.
- Number of defects or abnormalities for which further attention is indicated.
- Correlation of the abnormalities found with those corrected.

# Planning and Management . . .

## Administrative Management Concept Is Supported

If health officers availed themselves of modern administrative practices, they could devote more time to medical matters and less to administrative duties, stated Murray L. Nathan, LL.B., director, of-

fice of planning and procedures, and Herman E. Hilleboe, M.D., M.P.H., commissioner of health, New York State Department of Health, Albany.

Personnel and fiscal management have developed into specialties for which professional public health officers have not been trained, they said.

Nathan and Hilleboe defined administrative management as overall administration rather than any specific phase of management or administration. Its goal in public health, they said, is to create an environment in which many persons from different disciplines may aid health officers to reach a common objective.

"Administrative management is not a catchall for miscellaneous clerical duties but is an activity involving high skills in management and operations control," they stated. "To handle skillfully a complex administrative problem is as significant to the progress of public health as a well-executed epidemiological investigation of an outbreak of disease."

## *Approach to Problems*

One of the features of administrative management is its systematic and analytical approach to problems, Nathan and Hilleboe continued. Public health activities and objectives must be analyzed and evaluated to determine how well they meet the needs for which they were established and whether each activity is an appropriate responsibility of government or of private groups or individuals, they stated. Health workers must define priorities among their activities, point out special areas for needed research, suggest, develop, and test new programs, recommend for adoption only those which have had successful tests on selected populations, and be alert to the appropriateness of a particular activity as a government responsibility, they said.

In health department organizations, such nonmedical titles as "deputy commissioner, administrative services," "personnel administrator," and "director of planning and procedures," indicate that, with the delegation of important administrative duties to persons especially trained and experienced, "administrative management has come of age," they pointed out.

## *Training Personnel*

When the concept of administrative management has been accepted

by the health department, the health officer has the practical problem of acquiring trained personnel, Nathan and Hilleboe said.

Some schools of public health now offer courses in nonmedical administration leading to a master's or a bachelor's degree in public health. A school of public health is an ideal place to train these people, they said, and joint training of medical and nonmedical public health personnel should lead to joint working arrangements in the field.

In conclusion Nathan and Hilleboe stated that a continuing program of education, training, and research must be carried on in health departments to keep personnel currently informed of changes in administrative management and public health, to develop new techniques, and to put these techniques into practice quickly. Also, administrative management personnel themselves must take advantage of every academic aid offered.

## **Philadelphia Simplifies Sanitation Records**

A new system for recording sanitation inspections, using a single record form, is employed in Philadelphia's milk and food sanitation program.

Morris Shiffman, D.V.M., chief, milk and food section, and Paul W. Purdom, director, division of air pollution control and environmental sanitation, Philadelphia Department of Public Health, reported that the system was field tested for a year and proved to be successful in operations research.

The new record system fits in with the new inspection system which was adopted several years ago when the Philadelphia Department of Public Health reorganized the division of air pollution control and environmental sanitation and changed from a specialized to a generalized type of inspection, Shiffman and Purdom stated. Under the new system, the sanitarian is responsible for all

types of inspection of milk and food establishments as well as for other phases of the environmental sanitation program.

They said that the concept of sanitation unit operations and processes opens up new opportunities for the simplification of sanitation record forms. Multiple forms may be replaced by basic single forms to include any group of related environmental sanitation activities.

## *Single Record Forms*

All data are now recorded on a single sanitation form and are processed by the IBM punched card method, Shiffman and Purdom stated. The single form serves three purposes: It provides the inspected establishment with a positive, clear indication of what is required to meet standards and improve operations; it gives the administrator the information that will aid him in program planning and evaluation; and it provides legal records.

The single record form does away with the need for a separate form for each type of milk and food establishment, Shiffman and Purdom said. In addition to the general heading, there are two separate information areas on the form. One consists of ruled lines and columns where the sanitarian lists his recommendations to the establishment; the other is a check sheet intended solely for departmental information and data for the IBM punched card records.

The sanitation items included in the check sheet are selected to cover those basic operations and processes which are essentially common to food and milk establishments and which give useful information for analysis, they said. The methodology for the choice of items is analogous to the concept of unit operations and unit processes in chemical engineering and food technology. Extraneous detail has been avoided so that the analytical system does not bog down from the sheer weight of detail.

## Uses of Data

Some of the data currently derived from the record system include an enumeration of specified sanitation defects found on inspections and information as to whether these defects have or have not been corrected, Shiffman and Purdom said. In this way, the degree of compliance with any recommendation can be measured. Provision is made for analysis of survey items and for field research projects.

In conclusion, they stated that the completed analyses permit a measure of the effectiveness of personnel and an evaluation of the methods and activities of the organization. The problem areas may be pinpointed and success or failure in correcting any sanitary defect may be measured.

## Executive Must Clarify Management Role

A definition for "management personnel development" is to "get people to do more than they themselves think they can do," according to Virgil K. Rowland, personnel assistant to the vice president and secretary, Detroit Edison Co., Detroit, Mich.

Managers frequently do not know what is expected of them or what they should expect of subordinate management personnel because the department head has not discussed with them the responsibilities of the job or the standards of job performance, Rowland stated.

Job descriptions, performance standards, and individual evaluation of job performance provide a basis for improving managerial performance, he said.

### Job Descriptions

A job description should be more than a list of the manager's specific duties; it should include a statement that management functions include the broader phases of management, such as responsibility for plan-

ning, controlling and executing; being a leader of subordinates; and directing the work of others.

Rowland said that too often job descriptions are merely statements that the job of subordinates, including managers, is to get the work out. The manager's responsibility is to direct others, not to get the work out himself, he emphasized. Companies which define a manager's job with a description of the duties and responsibilities of subordinate managers are in the minority, he added.

### Performance Standards

Department heads are apt to feel that managers should know what their responsibilities are and how to carry them out. "We feel that we are insulting their intelligence if we try to tell them how to be good managers," Rowland stated, but it is the responsibility of the executive and not the personnel director, the industrial relations man, or a staff member, to talk with the manager about his job and the standards of performance he is expected to meet.

Rowland cited the experience of the president of a company with his sales manager. The man was an excellent salesman and the company's sales were the envy of its competitors. The sales manager had been helpful to the president in many ways and had set high quotas for sales. But, said the president, "I still had the feeling that my general sales manager was not part of my team."

Discussion disclosed that throughout a close association of 12 years each had suspected that the other was unhappy in the relationship, and that the sales manager was about to go to another company. Furthermore, the president found that the sales manager did not know what his job was. "I couldn't censure him for that," the president said, "because I realized that I hadn't discussed it with him."

Together, they determined the major segments of the sales manager's job and a satisfactory level of performance, as well as his respon-

sibility for planning for future growth. A few days later, the manager called a meeting of his regional sales managers, and a week later they met and set standards for their own jobs. That, said Rowland, "is management personnel development in action."

### Evaluation of Job Performance

To be helpful to employees and effectively to evaluate their job performance, management personnel must discuss with each individual the evaluation of his job. This is where management often fails, Rowland said. "We do everything but talk to the individual about his evaluation. And the reason we don't do it is because our boss, the next man above us, has not insisted that we do it. We do what the boss inspects, not what he expects," Rowland pointed out.

"The boss must know in what areas his employee is doing a good job and in what areas he needs to improve. . . . Individual evaluation of managerial performance is becoming an accepted philosophy in many companies today," and it is "a responsibility that cannot be delegated," he emphasized.

In conclusion, Rowland stated that any one of three techniques—statement of responsibility and authority, determination of performance, and evaluation and discussion of his performance with each employee—will improve managerial performance. When all three techniques are used and interrelated, the results are compounded and the improvement begins to be apparent in the profit and loss statement. Companies using these techniques can pay their employees more and can reduce their production costs, he said.

## Michigan Broadens Use Of Marginal Punchcard

An adaptation of the marginal punchcard system of recording environmental health activities and

programs has extended the use of this method and has made possible a more thorough and intensive administrative review of departmental functions, according to Vinson R. Oviatt, B.S.C.E., M.P.H., engineering consultant, hospital unit, Michigan Department of Health, Lansing.

Almost all record systems record historical facts, Oviatt stated, but assembling information requested by other agencies usually is expensive to the health department in terms of personnel time. Furthermore, he said, few record systems provide information needed to plan workloads within units and departments, to justify budget request expenditures, and to plan programs, or provide bases of communication to the public, to superiors, or between sections or divisions of a working unit.

After studying the relative merits of mechanical and punchcard systems, three Michigan public health workers selected the marginal punchcard system as the simpler and more economical. The only equipment needed is a hand punch for notching the cards, an alignment block, and a sorting needle, Oviatt said, although offices having a large number of cards to count and sort may purchase other equipment which will speed up summarization of the data.

The system has a number of advantages for reporting and recording sanitation activities and services, Oviatt stated. These are: rapid collection of information; summarization of records and data without transcription; only one form necessary; variation in use with the same basic forms; economy in cost of equipment and forms and in personnel time; relatively accurate and extensive use of quantitative data; compatibility of information among health departments; and logical balance between field and departmental use of records.

## *Punchcards and Forms*

The marginal punchcard and the inspection form are essentially identical, with two exceptions, Oviatt

said. The coding information on the card does not appear on the inspection form, and a condensed check list of sanitation items usually inspected at all types of establishments has been added to the bottom of the punchcard. At the end of the check list, several items have been left blank for the use of individual sanitarians in recording selected data. Several unallocated code sections have also been left for coding special studies or data.

Space has been left on the inspection sheet for the sanitarian's remarks to the operator of the establishment and, at the bottom of the sheet, for signatures of the inspector and the operator.

Michigan uses a multiple-purpose form, Oviatt said, that can be used not only for reporting sanitary inspections of all types of establishments—food, milk plants and producer farms, slaughterhouses, and sewage treatment plants—but for coding data on all other programs of the health department and for recording complaints. The heading of the form has space for the date, names of establishment and operator, address, establishment number, license number, location, and type of establishment, and for the name, address, and telephone number of the complainant. Individual check lists for the different types of establishments are carried in the sanitarian's notebook.

## *Coding and Filing*

The American Public Health Association code for reporting sanitation activities and programs is the only code specified for general use with the marginal punchcard system, Oviatt stated, and in Michigan, this master code has been expanded to fit sanitation practices in that State.

Each health unit records the data in the same way, although each one must work out its own code for geographic location and identifying numbers of sanitarian and establishment.

Each sanitarian notches the

punchcard when he fills out the inspection form. This not only saves office time but insures accuracy in coding because if coding is done by clerical personnel, some misinterpretations of the sanitarian's findings are bound to occur, Oviatt emphasized.

Cards may be filed by program, by sanitarian, by area, or by any other method that fits the needs of the health department, he said, and they may be summarized as often as necessary. Most health departments summarize data monthly.

## *Other Uses*

Punchcards have been useful in recording office activities, such as time spent on a special program or on program planning, itemizing correspondence, or recording information, conferences, and staff meetings, Oviatt stated.

In Michigan, monthly reports of programs, by activities, enable the State health department to evaluate health programs with a minimum of effort. Among the various uses made by individual health units of the data obtained by the marginal punchcard method are reporting of services to political subdivisions, providing summaries of activities to controlling governmental bodies, time and cost analyses, comparison of services to different areas, analysis of work of individual sanitarians, and evaluating and planning of programs.

The system can be used to evaluate programs, establishments, or geographic areas over a period of time by comparisons of types and numbers of activities, number of deficient items, and approval status. However, sanitarians and statisticians in Michigan are exploring other adaptations of this method in measuring the quality of an activity or program, Oviatt stated.

In conclusion, he reported that the success of field trials of the marginal punchcard system has resulted in its continuation in the trial areas and in its adoption of health units outside these areas.

## Cooperation of Agencies Still a Major Goal

Cooperation between health and welfare agencies can be achieved; it can produce improvement in services to people; but it is still not often practiced.

This evaluation was the conclusion of Jonas N. Muller, M.D., M.P.H., staff director of the Subcommittee on Medical Care, American Public Health Association, and Pearl Bierman, M.A., medical care consultant, American Public Welfare Association. It is based on visits with State and local health and welfare department personnel in eight States and current reports in the literature.

Many different forms and degrees of cooperation are found, they specified. However, most cooperative efforts are somewhat remote from the recipients of services, and few are vigorously directed at health goals. Cooperation is rarely explicitly defined in policy terms, they added.

Not noncooperation, they explained, but simply no relationship at all on the administrative level, is the usual situation. Many health officers, however, informed Muller and Bierman that they avoided making any special provisions for health services to the indigent for fear the health department might be labeled as an agency for this group.

### *Areas of Cooperation*

The major area of well-defined cooperative effort among State agencies centers around boarding homes and such institutions. They are particularly cooperative on licensing programs, Muller and Bierman noted. Such efforts range from contractual agreements for the participation of several agencies to informal but regular visits by field personnel of the licensing agency to other agencies. In California, for example, a tripartite agreement concerning standards and licensure responsibilities for sheltered care facilities for older people provides for consultation services from the State

departments of public health, social welfare, and mental hygiene.

For the most part, they stated, the cooperative efforts in this area are effective. But their potential for improvement of institutional services has barely been tested. Nor have they been sufficient to bring about consideration of other areas of mutual concern.

Muller and Bierman pointed to the lack of application of preventive services through joint effort as the most glaring gap. One welfare agency head even suggested that any notification to welfare clients of the availability of preventive services would constitute coercion and that it was therefore not an appropriate activity, they specified.

In the field of chronic diseases and adult rehabilitation, the situation seems to be little better, although possible pointers to future patterns exist in a few States. In cancer control, for example, State welfare departments have some responsibility in at least eight States.

At the local level, the greatest evidence of cooperation is in the area of direct services, according to Muller and Bierman. Usually, the cooperation is among the workers, not the agencies, and is informal and unplanned.

### *Five Basic Goals*

If the preventive approach to health and welfare problems is to be followed effectively and economically, cooperation between health and welfare agencies must be greatly increased, they declared. They said that the following basic goals are still to be achieved:

1. The application of the normal program of the health department to the welfare population through active cooperation with welfare agencies.

2. The development of appropriate health promotion and disease prevention activities in the welfare program itself.

3. Recognition of the opportunities for improved health and welfare services inherent in areas of overlapping responsibilities, such as the

licensing of institutions, rehabilitation, and certain aspects of tuberculosis control.

4. An increased awareness of the social and economic needs of persons coming to the attention of the health department and a clear understanding of the responsibilities and the potential activities of the welfare agency in support of people with such needs; and an understanding of health needs and of the resources of the health department by the welfare department.

5. The development of the necessary policy and procedures to achieve economical and efficient services, without duplication, when several agencies are concerned.

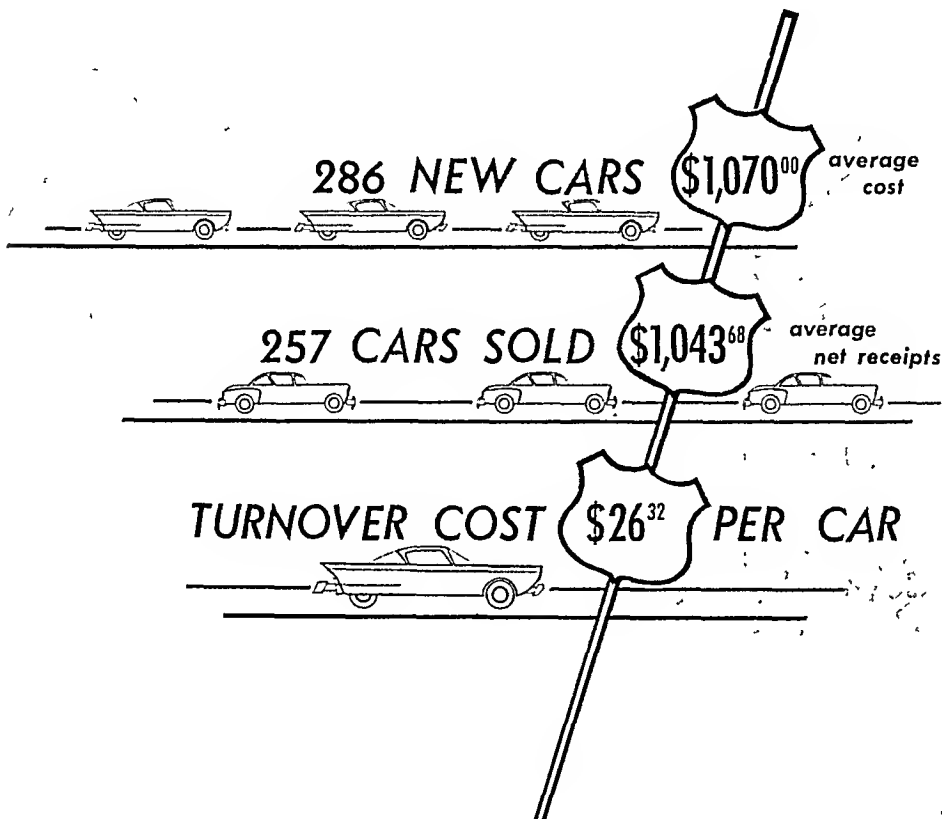
## Annual Fleet Purchase Pays in Maryland

Mileage costs for transporting Maryland State Health Department personnel have been reduced to 3.1 cents per mile—a saving of 3 cents per mile over former years—by the use of an annual fleet turnover plan.

Clemens W. Gaines, B.S., chief of the department's bureau of management, described the plan and discussed how the reductions in costs came about.

Formerly, Maryland bought 285 automobiles, 230 of which were assigned to rural areas. These cars serving 680 employees were driven an average of 9,500 miles annually and were replaced in 6 years or at 60,000 miles, whichever came first. The fleet was managed and serviced by an 8-man staff in a central garage.

Under the present plan, new cars are purchased on a bid basis at prices reflecting wholesale rates. They are resold at the end of the year to highest bidders, usually at prices reflecting the one-third depreciation from retail list prices. Thus, Gaines explained, the State has the opportunity to purchase a new car with little more than the proceeds realized from the sale of an old one.



The figures for 1955 show that the department was able to acquire its new cars at a cost of about \$26.32 per car, a figure which includes \$12.70 for the administrative costs incurred in selling the old.

For the same year, the itemized mileage costs in cents were as shown in the table below.

Gaines pointed to the following features in the plan which have resulted in reductions in overhead and operating costs.

- Only regular grades of gas and the cheapest separately packaged and sealed oil are purchased under 6-month contracts with local service stations.

- Garaging of cars has been eliminated.

- There is no depreciation from injury to the finish, caused by removal of State or official seals from the door; instead, cars use a metal tag reading "Official Use—State of Maryland."

- The purchase of seat covers has been discontinued.

- Instead of buying black cars and the cheapest model of one manufacturer, the State buys from the manufacturer submitting the lowest price for cars which have good resale values.

- Since the cars are new, there are few repairs; thus, the central garage is scheduled to be vacated this year, and only one person will be retained to manage assignment and repairs.

- It is planned to assess nominal charges on personnel using the cars for commuting purposes.

Since about 165,000 used cars are sold each year in Maryland, the size of the deal, 286 cars, does not seriously affect the used car market, Gaines said.

The plan, which saved \$85,000 out of \$153,000 in 1955, makes it possible to use more of the tax dollar for di-

**Mileage costs, in cents, Maryland**

	<i>Before</i>	<i>After</i>	<i>Difference</i>
Operating expenses (gas, oil, maintenance and repair supplies, and liability insurance coverage).	3. 6	2. 3	1. 3
Overhead expenses (administrative, renting garage, salaries of maintenance people).	1. 2	. 8	. 4
Depreciation.....	1. 3	( <sup>1</sup> )	1. 3
<b>Total.....</b>	<b>6. 1</b>	<b>3. 1</b>	<b>3. 0</b>

<sup>1</sup> Included in overhead expenses.

rect health services by clinicians, nurses, statisticians, and others, he concluded.

## Profile of Health Worker Drawn From Yale Project

The average public health worker enters the field of public health after 7 years' experience in other fields. His entry into public health is most often the result of chance, personal contacts, or the inherent attraction of the work. In addition to his other experience, the average worker has had 10 years' experience in public health.

This picture of the public health worker is based on findings of the Yale Public Health Personnel Research Project, which were reported in summary form by Edward M. Cohart, M.D., deputy director of health, New York City, and Ira V. Hiscock, Sc.D., chairman of the department of public health, Yale University School of Medicine. (Several detailed reports of the study have been published in this journal.)

Through interviews, observation, and time studies, the Yale project obtained information on education, work experience, satisfactions and dissatisfactions, and activities of public health workers. A total of 1,129 personnel in selected State and local health departments in 4 States were studied, although not all were included in each phase of the project, according to the Cohart and Hiscock report.

Their summary, they noted, provides "good approximations of the facts, rather than scientifically exact descriptions," because of State-local differences and the way in which the sample of health departments was selected. Other findings, as reported in their summary, are given below.

Sixty percent of the public health workers possess bachelor degrees. About 27 percent hold graduate degrees, but only a minority of these have degrees in public health. Education in the natural sciences is the

rule; education in the social sciences is uncommon.

Most public health workers are happy to be in public health, but 1 in 7 feels that he would like to work elsewhere. More specifically, unsatisfactory conditions of work and low salaries are the most frequent reasons for discontent. Relations with fellow workers are the greatest source of satisfaction.

### *Distribution of Working Time*

Distributions of working time to public health programs and to specific functional categories of activity were each studied in one State. Cohart and Hiscock stated. On these phases of the Yale project, they reported the following:

In local health departments, between 33 and 50 percent of all working time is devoted to maternal and child health; 25 percent to environmental sanitation; approximately 10 percent, respectively, to communicable disease, tuberculosis, and venereal disease; and about 4 or 5 percent, to chronic disease, mental health, industrial hygiene, and civil defense, combined. There is some overlapping of these divisions.

In the State health department, venereal disease receives major emphasis, closely followed by maternal and child health. Orthodox sanitation programs account for 10 to 15 percent of the time, but another 20 percent is devoted to industrial hygiene. Tuberculosis and communicable disease each takes about 10 percent of the time. And the remaining 10 percent is devoted to chronic diseases, mental health, and civil defense.

About one-third of the time of health department personnel is devoted to giving direct services; one-third, to administration and community activities; and one-third, to supporting activities.

Cohart and Hiscock felt that the findings of the Yale project "should serve as useful preliminary observations," even though future studies on a broader base may alter the percentages. "The findings are to be looked upon not merely as a descrip-

tion of existing conditions, but, even more, as the necessary information for an assessment and evaluation of current public health practices, especially in relation to factors of administration and personnel," they said.

## Record and Evaluate In One Technique

New Jersey has a carefully designed technique for recording and adopting public health programs which its proponents maintain can minimize subsequent difficulties in program operations and simultaneously serve as a potent factor in achieving critical evaluation.

The new technique was described by Daniel Bergsma, M.D., M.P.H., and Lawrence M. Friedrich, M.C.E., M.S.P.H.E., commissioner and assistant to the commissioner, respectively, New Jersey State Department of Health.

The method of recording is not an end in itself, they stated, but an orderly administrative process to record and evaluate a plan of procedure for each specific, stated goal designed to prevent disease or to enhance the health of the community.

When clearly stated, they declared, adopted objectives constitute a summary of the need or problem, a reflection of background philosophy, a declaration of intent, and the indicated policy. The adopted activities indicate scope; may further clarify needs; usually imply personnel, time, space, coordination, and integration; and always imply procedure and policy.

### *Four Basic Parts*

They explained that plans recorded by this technique contain four essential parts:

Part I contains a statement of specific public health needs. This expresses the lack of anything requisite, or the presence of anything harmful, to optimal health, plus the concise enumeration of related problems. Pertinent statistical data are



included. The purposes of part I are to justify the proposed plan, to define the situation, and to provide a baseline for measuring progress.

Part II states the objectives of the particular program, the specific activities for each objective, designates responsibility for each activity, and provides the first broad guidelines on cost.

Part III consists of general guidance for the program and explicit detailed procedures for each activity. The third part is designed to provide all factual and procedural data necessary for an employee with minimum training to conduct each of his activities correctly and is intended to leave only carelessness or poor judgment as reasons for failure to act correctly.

Part IV contains the predetermined yardstick or indexes to measure progress in terms of the program as a unit or of the objectives. This consists of a series of built-in evaluation indexes which emphasize accomplishment and quality.

Three facts stimulate optimal performance and critical self-appraisal of any program writer when the method is used, they commented. Every item of every program has its assigned place on the prescribed format and can readily be cross-checked by a reviewer. Colleagues and superiors of a program chief will constructively, but critically, review his program and determine by group judgment whether or not it is consistent, adequate, and practical; everyone involved is free to, and is urged to, send suggestions for improvements to the department head.

Most programs were rewritten at least once or twice, and some three or more times before unanimous or majority adoption, they said. This provided a significant training period for the personnel recording a program, strengthened the realism and logic of the approach, increased efficiency of performance, imparted a sense of accomplishment, improved morale, and heightened appreciation of departmental problems and goals.

The selection of students is another responsibility that the health agencies share with the schools of public health, according to Vaughan and Getting. Basic to securing good personnel is, of course, the recruitment of people of integrity, intelligence, morality, and maturity. In addition, if the teaching of public health is to be improved, the students must be leaders in their chosen disciplines, that is, in medicine, nursing, health education, engineering, or nutrition, for example.

Vaughan and Getting also felt that ideally every student should have some public health experience prior to matriculation. This experience should be planned; it should be obtained under supervision; it should be as broad as possible; and it should lead to increasing responsibilities, they specified.

One way of assuring the schools of qualified students, they said, is through careful selection of candidates for fellowships by the agencies that have fellowship programs. Unfortunately, there are not enough fellowships available, they added, urging that all State and large local health agencies, both official and voluntary, plan specific training programs, including intramural postgraduate education.

## *Theory Into Practice*

"Every course of instruction in a school of public health leading to a graduate degree should be so designed that the recipient will be prepared for the practical application of the theory and dogma which he has encountered during the school year," Vaughan and Getting emphasized. By this, they said they meant that opportunities to relate academic instruction to field practice must be provided as the program of instruction progresses, not before nor after the course of instruction. Too frequently, they pointed out, academic exercises are drawn from the files on situations of yesteryears rather than from situations existing today. They recommended a blending of history and everyday problems in the course of instruction.

# Professional Education, Training . . .

## Agencies Can Aid Schools In Preparing Careers

Health officers must aid the faculties of schools of public health in preparing personnel for health agencies by indicating what they expect the graduates to obtain during the period of instruction, stated Henry F. Vaughan, Dr.P.H., and Vlado A. Getting, M.D., who presented the schools' views on how the teaching of public health can be improved.

Drs. Vaughan and Getting are, respectively, dean and professor of public health practice, University of Michigan School of Public Health.

As personnel, duties, and responsibilities in health agencies change,

so courses of instruction must be altered to meet these needs, they said. Whenever possible, the schools should anticipate the future needs of health agencies and prepare students for future duties and responsibilities.

At present, they said, because of the general evolution taking place in the character and nature of health services, the schools must prepare students for any eventuality, be it medical care administration or home care of the chronically ill. Until the health officers can give more definition to the future horizons of health programs, the schools would be derelict in their duty should they restrict their teaching program to a narrow approach to health matters, they added.

Along the same line, they mentioned the necessity for the faculty's keeping up to date on public health practice. Keeping "one foot in the field through active association with progressive health agencies" is an advantage for the teacher that cannot be overemphasized, they said.

Also of paramount importance is the selection of the faculty, Vaughan and Getting noted. They described the ideal faculty member as "a professional person with a wide variety of experiences." Rarely should a person be selected who has not had continuing experience in the practice of public health, preferably in a local health department as well as in a State agency, they said.

## Health Department's View Of Teaching Public Health

Seven questions related to the problem of improving the teaching of public health were raised by Franklyn B. Amos, M.D., and Herman E. Hilleboe, M.D., director of the office of professional training and commissioner of health, respectively, of the New York State Department of Health, Albany.

The gist of their comments on each question reflecting the health department viewpoint follows:

**Objectives of the graduate school of public health.** An analysis of the backgrounds of medical M.P.H. candidates in all graduate schools in 1951-52, as reported by the Committee on Professional Education, reveals that there were 98 foreign students, 86 native students with prior public health experience, and 33 native students without such prior experience. Perhaps those schools with a preponderance of foreign students aim chiefly to provide training for foreign public health; those which accept students without previous experience, to provide initial preparation for the job.

**School admission policies.** Relaxation of the 3-year experiential requirements for most candidates might solve some recruitment prob-

lems, but necessary professional and personal characteristics should be part of the admission criteria of all schools. Intellectual capacity and professional knowledge should be such as to indicate ability to complete work at the master's degree level.

**Curriculum policies.** Part of the problem in setting educational goals is the lack of agreement on the area of knowledge to be included in public health. The number of electives offered at the schools varies from 15 to 127. More courses in the social sciences and administrative sciences are needed by many schools.

**Teaching techniques.** Prominent researchers do not always have teaching abilities. Responsibility for assuring the teaching skill of faculties should be assumed by individual schools. If teachers lack such skill when appointed, provisions should be made for their instruction on teaching arts.

**Integration of field experience and academic study.** The amount of field experience required of students by schools is minimal. A rotating system of short periods of academic training followed by field experience might be a better way of integrating the actual practice of public health with the student's instruction in theory. A few schools have approached this program in the major fields of study, but such a modification of present schedules would entail meeting a number of new difficulties. Problems to be solved would include maintaining a 12-month staff, finding satisfactory field training centers, and preparing local health departments for the addition of field training to their activities.

**Provision of continuation courses.** One of the needs of the practicing public health worker is constant study to keep abreast of recent developments in his field. Responsibility for providing short continuation courses for the professional worker after graduation belongs to the schools.

**The health department's responsibility.** Health departments should have active recruitment programs.

They should help screen applicants and recommend to schools only those candidates who meet the requirements for advanced work. State and local public health training needs must be interpreted to budget directors by health departments. Finally, if public health objectives are to serve the continuing need for improved health, health departments and public health schools must sustain a mutual exchange of information on current needs.

## Resistance to Change Requires Attention

To meet the challenge of relatively unexplored areas in public health, the content of health education of the future must secure changes in individual and group behavior and must develop more precise methods in stimulating and bringing about acceptance of such changes.

Nell McKeever, M.S.P.H., assistant chief, Public Health Education Services, Public Health Service, on behalf of herself and her chief, Mayhew Derryberry, Ph.D., spoke on what the changing public health picture means to health education programs and practices.

Health educators, McKeever believes, have the responsibility of finding ways of accelerating indicated behavior change in the way least upsetting to the established behavior pattern of the people and within their potentialities.

## Future Programs

Health education will continue to look to the natural and developmental sciences for its content, but at the same time it will continue to turn to the social sciences for its methods and techniques, McKeever said.

She forecast that future health programs can expect to deal with alcoholism, and its emotional and social implications; with suburbia, and the impact of large population groups on obsolete administrative machinery; with varying population

groups, and the educational and social problems accompanying integration. Still others will attempt to bring effective public health measures to new industrial areas, overcrowded school systems, limited rehabilitation areas.

The medical education of tomorrow will demand creative, imaginative experiences to enrich the quality of medical and community leadership, she continued. Patient education, at present an example of how ideal learning situations are too often blocked by apprehensions and misunderstandings in emotionally charged situations, will present still another challenge, she noted.

Education should be ready to supply more scientific determination of the situation, to test methods to overcome the individual's and group's resistance to change, and to provide objective measurement of behavior change, she said. Education should know when to use the instruments and investigative procedures that are already available, she added.

### *Social Science Research*

McKeever was of the opinion that the effective adaptation of social science techniques to health education will require both a closer working relationship with social scientists in practical field operations and more training in social science for health educators so that they will feel secure working in the behavior area.

Public health practitioners who are seeking an all-purpose answer to how to strengthen the process of health education may be overlooking the necessity for thoughtful diagnosis of the educational problem involved in getting people to benefit from the medical discoveries of the day, she believes.

For improvement in health to be achieved by the constructive action of individuals and groups, there is need for understanding, need to diagnose the individual's behavior, his beliefs, his motivations, his goals, and at the same time to acquire knowledge of the group's goals, traditions, beliefs, practices, values, and cultures, she said.

The public health profession, and health education in particular, can benefit from: (a) social science studies focused on the individual's attitudes and past experiences that facilitate progress or create barriers to change, (b) insight into the leadership-followership patterns established by the people, (c) exploring the accepted channels of communication, and (d) considering the objective advisability of change and the individual's or group's acceptance of change.

She cited the publications of Earl C. Kelley, Benjamin D. Paul, Fillmore H. Sanford, Kurt W. Back, Henry Clay Lindgren, Kurt Lewin, and Margaret Mead as making contributions applicable to the solution of educational problems in these areas.

### **"Unaccustomed as I am . . ." No Excuse at Tulane**

Recognizing that knowledge in public health does not by itself always make an effective public health officer, the department of tropical medicine and public health of Tulane University offers two courses in oral communication for students working toward the M.P.H. degree.

Both courses are taught by John M. Erickson, assistant professor of business administration, who described the university's experiment in "breaking the communications barrier."

Tulane requires the oral presentation of a previously written term paper before students and faculty at the end of the academic year. Erickson said that dissatisfaction with poorly delivered papers plus realization that students were not well equipped to use the substantial body of knowledge they possess led to making the courses a regular part of the public health curriculum.

All public health officials should be able to communicate to other responsible officials and to the general public the significance of their work

and what it means to the average citizen, he said.

If students could do no more than read their papers, they could not be effective in presenting their needs for an annual budget, in presiding over staff meetings, or in seeking luncheon club support for health campaigns, Erickson said. The Tulane courses not only duplicate these situations but provide opportunity for panel-type discussions before hypothetical audiences and for training in the handling of hecklers.

The beginning course gives practical experience in a public speaking situation and is a required 6 hours a week during the first quarter of the academic year. The work is designed to enable students to use the basic principle of communication, namely, that the speaker must secure and hold the attention of the audience on those ideas that tend to make the audience respond as the speaker wishes it to respond.

Along with the development of good speaking habits, the student learns to think in terms of his audience and to phrase his thoughts in words to which the audience will give the same meaning that he gives.

The second course teaches use of the oral communication principle in group situations. It is elective, and meets 2 hours a week in the second quarter. The student participates in informal committee work preparatory to a formal meeting in which the desired end is sought. Both situations are related to each other in organizational concept.

The courses have produced the desired development in effective oral communication, he continued. Students who were unable in the early classes to achieve directness in talking to others have changed into confident but not overconfident individuals. They show they have learned how to motivate audiences. Improved speaking manner, ease, and poise before a group, and the ability to convey ideas are the most obvious results, but most important, Erickson said, is to watch the growth of a personality as it finds new means to make life effective.

During the first sessions of a class, students show some resentment about a course which they consider out of place in a public health curriculum, he continued. The resentment is replaced by enthusiasm when they see their fellow students progress in the presentation of ideas. The improvement in the presentation of the term papers has been so marked that the faculty is convinced of the value of the courses. Graduates in their subsequent careers frequently refer to the value of the training.

## Offer Sanitation Training In New York Program

New York State's comprehensive training program is offered before and during employment in order to provide competent, qualified sanitation personnel, according to Meredith H. Thompson, Dr. Eng., assistant director, bureau of environmental sanitation, New York State Department of Health, Albany.

Sanitation personnel receive coordinated and complete training. A full-time sanitation training specialist directs the program, he declared. The training unit plans, coordinates, and conducts most short courses for sanitation personnel.

Unless an efficient and continuous training program is provided, personnel cannot be expected to work at peak efficiency, he asserted.

The sanitation training program is part of the State public health training program for all department personnel. The State health department is convinced that coordinated and interdisciplinary training is basic to the team approach to public health problems, he stated. Training for health officers in New York State began in 1934, for public health nurses in 1936, for statisticians in 1938, for nutritionists in 1945, for health educators in 1948, and for sanitation personnel in 1951.

### Preservice Training

Preservice training for sanitary inspectors may be an eligibility re-

quirement to a beginning permanent position. The beginning permanent sanitary inspector in local health departments must have a high school education and 2 years' public health experience, he said.

These personnel ordinarily cannot obtain the prerequisite experience, and, consequently, a 3-month training course, approved by the New York State Public Health Council, has been made available and is accepted as the equivalent of 1 year's experience. The New York Field Training Center, at Mt. Vernon, N. Y., is a cooperative venture of the Public Health Service and the New York State Department of Health. The trainee may be granted a waiver by the public health council from the necessity of a second year of experience, Thompson explained, and thus he may be employed while he obtains the second year's experience.

### Inservice Training

Inservice training prepares permanent personnel for progressively responsible or specialized positions, he said. Such training ranges from short orientation courses to a full year of academic study leading to a master's degree in sanitary engineering or public health.

Orientation is scheduled as soon as possible after permanent employment. About 1 week is spent in non-sanitation units of the health department in order to give the employee needed knowledge of the overall objectives, policies, and activities of the entire department, Thompson reported.

The employee receives about 11 weeks of orientation in sanitation. He spends 3 weeks in the central office and 8 weeks in various field offices, observing and working, he explained. After this first orientation, further orientation is continued during the succeeding years on a less formal basis.

Subjects for the short 3- to 10-day nonacademic courses include epidemiology, basic bacteriology, bacteriology of water and sewage, bacteriology of milk and food, sanitary chemistry applied to water, sewage, milk, and food, statistics in sanitation, refrigeration, dairy farm sanitation, milk pasteurization, plant sanitation, food sanitation, public water supplies, basic radiological health, radiological health instrumentation, educational methods, public speaking, and public health administration.

Courses are held throughout the State to accommodate city and county personnel and are given by health department or university specialists. Although attendance is not compulsory, Thompson commented, courses are usually oversubscribed and some applicants must wait until the class can be repeated. Attendance is usually limited to from 12 to 20 persons.

All State health department personnel are permitted to apply for and, if accepted, to attend those courses in which they are interested. Generally, an employee may attend two 1-week sessions per year, Thompson said. Selected engineers and sanitarians may be authorized to attend universities and colleges for formal academic training.

## Child Health Services . . .

### Georgia Canvass Finds Handicapped Children

The greatest single need in the rehabilitation of handicapped children is for family counseling, stated Sam-

uel M. Wishik, M.D., M.P.H., professor of maternal and child health, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, Pa.

A study made by the Cerebral

Palsy and the Crippled Children's Societies of Georgia indicates that an estimated 10 percent of all children under 21 years of age have one of the 12 handicaps included in the study. Most of the handicapped children have more than one disability, he stated.

The Georgia study, according to Wishik, is the first attempt to estimate for a single community the prevalence of 12 handicapping conditions—cerebral palsy, cleft palate and lip, cosmetic abnormalities, epilepsy, eye disease and disturbance of vision, hearing impairment, heart disease, mental retardation, orthodontic and orthopedic conditions, personality disturbance, and speech difficulty.

## Case Reporting

Both professional workers and interested citizens took part in the study, Wishik said. All persons in the community were requested to report to the local health department children whom they suspected of being handicapped. Copies of a set of questions were given wide publicity through churches, stores, newspapers, and other means. Parents, physicians, nurses, teachers, school health workers, neighbors, and friends of the children reported their handicaps to the societies.

Following 3 weeks of voluntary reporting, a sample canvass was made of every 10th household. The canvass technique was the more successful; only one-fourth of the handicapped children found in the sample households had been reported voluntarily. In general, handicaps found through canvass reporting included less severe ones which were not discovered by the voluntary method, Wishik noted.

## Clinics

Ten clinics were set up for the 12 diagnoses. Four to ten professional disciplines were represented on each clinic team, and, he emphasized, all professional services were given without charge.

All children were classified according to a presumptive or working di-

agnosis made by a pediatrician on the basis of reports received. A sample was then drawn for each diagnosis, and 85 percent of the canvass report cases and 41 percent of the voluntary report cases were invited to the clinics. The percentages seen were 63.5 and 33.1, respectively.

The responsibilities of the clinic teams were: to confirm, deny, or correct the presumptive diagnosis; to assess the functional disability of each handicapped child; and to estimate the services needed by each child.

Among the voluntarily reported patients, diagnosis was confirmed for 63.4 percent and 77 percent were found with some handicap. These percentages were slightly lower (51.4 and 64 percent) for cases reported by canvass workers, Wishik said. But even so, Wishik found that the canvass was 50 percent more effective than voluntary reporting in discovering the needs of handicapped children.

The number per 1,000 children under age 21 with any handicap was 108. The numbers per 1,000 with each diagnosis were:

Cosmetic abnormality-----	43
Mental retardation-----	40
Personality disturbance-----	29
Speech difficulty-----	29
Eye disease and disturbance of vision -----	24
Hearing impairment-----	19
Orthopedic condition-----	17
Orthodontic condition-----	16
Heart disease-----	10
Cerebral palsy-----	5
Epilepsy-----	4
Cleft palate and lip-----	1

The average number of diagnoses per child was 2.2, and the percentages of children with multiple diagnoses were:

Number diagnoses	Percent handicapped children
1-----	32
2-----	30
3-----	19
4-----	12
5-----	6

In assessing disability, distinction was made between the child's personal adjustment to his handicap and maladjustment of his family to the situation, Wishik stated. Assessment of the degree of social rejection was based on community attitudes toward factors such as ugly appearance or strange-sounding speech. Each child's problem was considered individually. There was little correlation between the degree of physical disability and the child's vocational limitation, his family's reaction, and society's rejection.

The association of mental retardation and personality disturbances with certain physical handicaps emphasizes the importance of psychology and psychiatry in crippled children's programs, Wishik said.

Estimates of services needed by each child were made at a staff conference. All the children needed diagnostic appraisal and a plan of care. About 70 percent needed counseling or guidance or their parents needed education; about 10 percent needed institutional care, he stated.

To meet the need for family counseling, new administrative patterns were recommended, such as local field extensions of a rehabilitation center, direct focus on patients by social workers in health departments, major units for the handicapped in voluntary child and family agencies, and specialized programs attached to a coordinating or referral agency. "Close working relationship between counseling and other service programs is, of course, essential," Wishik emphasized.

## Childhood Chronic Illness Control Progress Reviewed

Chronic illness and disability are not limited to old age but are found also in children and young adults, stated Thomas E. Shaffer, M.D., professor, department of pediatrics, College of Medicine, Ohio State University, Columbus, in reviewing progress

in controlling the common chronic diseases of childhood.

Although most chronic diseases cannot be cured, many can be prevented, Shaffer said. The progress of many more can be halted, and handicapping disability can be prevented if the disease is discovered and treatment is begun early. Periodic health appraisals and medical screening of school children are discovering many chronic illnesses during childhood, before the disease process is far advanced, he added.

"We know how to control rheumatic fever," he said. The problem is recognition of the streptococcal infections in children, administration of penicillin when the infectious occur, and teaching parents the importance of continuing prophylactic treatment even though their children appear to be in good health. Diagnosis of rheumatic fever on physical examination is difficult, Shaffer stated, but reliable and clinically practical laboratory tests are available and can be carried out in most laboratories.

### *Congenital Heart Disease*

X-rays, often supplemented by injection of materials into the blood stream to outline blood vessels and heart cavities, examination of blood samples taken directly from the heart, and electrocardiograms have made it possible to diagnose malformations of the heart with "almost the exactitude of engineering," Shaffer continued. Persons formerly faced with lifelong chronic disability because of malformed hearts can now be made normal, physically, through surgery, he stated.

### *Epilepsy and Diabetes*

The electroencephalograph for diagnosis and medication with new non-sedative drugs are the two most notable recent advances in the control of epilepsy, Shaffer said. None of the antiepileptic drugs in use today cause mental deterioration, he stated, and all epileptic manifestations can usually be suppressed with the newer drugs, singly or in combination. Radical surgical procedures

are available for those who do not respond to medical treatment.

Medical control of the disease has made it possible for epileptics to go to school with other children, to develop normally, and to go on to normal employment later in life, Shaffer said. Public realization of the fact that only a small percentage of epileptics are retarded mentally is increasing.

The development of insulins that can be taken only once a day is probably the most important advance in the control of diabetes since the discovery of insulin in 1922, Shaffer said. So-called regular insulin had to be given before each meal and often at bedtime. Since 1 child in 2,500 under the age of 15 years has diabetes, the effect of such a radical change in the insulin schedule upon the feelings of children about their disease and their social relationships in school and elsewhere is obvious, Shaffer stated. The current tendency to permit growing diabetic children to choose their food has also helped them to be considered as normal children, particularly in the classroom.

Shaffer said that medical science still has a "giant-size" step to take, the discovery of insulin that can be taken by mouth.

### *Cerebral Palsy and Tuberculosis*

The rehabilitation of cerebral palsied children so that they can live and work to the limit of their capacity is an outstanding advance in the cooperative treatment of chronic disease, Shaffer stated. Another milestone is the combination of special education and therapy—physical, occupational, and speech—in the treatment of cerebral palsy.

Location of active tuberculosis among adults and their prompt isolation and treatment have greatly reduced the chances of infection in children, Shaffer said. Drugs can prevent tuberculous infection, even as they halt progress of the disease among adults, he said.

### *Obesity and Cancer*

Obese children are no longer con-

sidered to be suffering from endocrine disorders, and treatment is directed toward controlling calories rather than prescribing thyroid and sex gland hormones, Shaffer stated. Obesity in childhood is often the result of the emphasis on weight gain in infancy, he said, and parents come to believe that plumpness is synonymous with health and happiness even after their children are no longer infants.

Health education and periodic health examinations contribute to the control of cancer, one of the most frequently fatal diseases of childhood. Radiation of tumors and surgical removal of new growth save the lives of children whose cancers are diagnosed in early stages, and chemotherapy has prolonged life in certain blood diseases. Medical treatment for the present is limited to the means of interrupting or reducing the progress of cancer diseases, Shaffer said in conclusion.

## **Cites Ten Principles For Rehabilitation**

Recent advances in rehabilitating chronically ill adults may be applied to restore handicapped children to normal daily living and activities, according to representatives of the bureau for handicapped children, New York City Health Department.

Discussing the new techniques were: Helen M. Wallace, M.D., former director of the bureau and now director, department of public health, preventive medicine, and industrial hygiene, New York Medical College, and Jerome S. Tobias, M.D., bureau consultant in physical medicine and rehabilitation and professor and director, department of physical medicine and rehabilitation, New York Medical College.

Also: Robert S. Siffert, M.D., senior orthopedic consultant to the bureau; Margaret A. Losty, R.N., coordinator of the bureau's hospital consultation program; and Caroline H. Elledge, chief medical social work consultant to the department.

## Ten Principles

They outlined 10 basic considerations for administrators and clinicians planning for the maximum restoration of handicapped children in the community.

1. The employment of a consultant in physical medicine and rehabilitation is as necessary as other medical consultants. His assistance might develop and evaluate physical medicine and rehabilitation services and develop standards for a department of physical medicine and rehabilitation. He might supervise the training in rehabilitation techniques for personnel in health departments, institutions, and crippled children's agencies.

2. Personnel on the staffs of institutions, crippled children's agencies, and health departments need training in the principles of maximum self-sufficiency which are being taught to patients. With the newer knowledge of rehabilitation techniques, the teaching of activities of daily living, such as feeding, dressing, toilet care, wheelchair transfer, ambulation, gait training, to children in institutions and at home could become dynamic.

3. The training program should be developed, both for the faculty and trainees, along the multidiscipline approach, which requires a battery of professional skills. The approach should result not in replacement of one type of professional worker by another but rather in a supplementation of one by the other and should apply to the initial evaluation of the patient, periodic reevaluation, continuous supervision, and counseling of the patient and his family.

4. Services for the rehabilitation of handicapped children and adults must be coordinated and integrated. Chronic illness does not magically begin at any age. The artificial separation of the "under 21" and "over 21" age groups merely confuses community planning with the resulting duplication of efforts, funds, and services.

5. Since rehabilitation of the handicapped child is frequently not

accomplished on a short-term basis, long-term care is often essential. Frequently the term has incorrectly meant long-term institutional care. It should imply the necessity of continuity of care, supervision, and rehabilitation for the child whether he is an inpatient or outpatient, whether he is at home, in school, in job training, or at camp.

6. If medical advances are to be made in improvements of methods, and if fiscal authorities and the public are to be convinced of the value of rehabilitation programs, studies are needed to develop even such basic evaluation data as the rehabilitation results to the individual patient for a given period of time, the most effective and successful techniques in certain types of disabilities, and the cost of rehabilitation per patient for each diagnostic group, by institutions and so forth.

7. The community's existing services and resources, available personnel, and public and professional interest are key factors in deciding priorities. A priority system must be established in the early stages of a program. Carefully worked out standards are essential to guide participating institutions as well as accrediting groups in approving adequate acceptable services for a payment program.

8. Quantitative and qualitative knowledge of existing services and resources and of current gaps in patient care should include: services provided by the hospitals and convalescent homes, resources for the homebound group of children, services provided at school, vocational resources, recreational programs, transportation facilities, long-term residential or custodial services, and the foster and child welfare services.

9. Close cooperation with the State and local agencies responsible for the administration of the newer Federal legislation would seem essential. The Hill-Burton and Vocational Rehabilitation Acts provide a means of improving and expanding services for handicapped children. Personnel engaged in crippled chil-

dren's programs already have considerable knowledge about current services and facilities.

10. Purchase of care on a cost basis is vital, for if this cost, usually high, is not met in some way, then services are automatically decreased by reduction of personnel. Some essential services therefore will not be provided, and rehabilitation will lose effect. Logical sources, in addition to the patient and his family, are the categorical voluntary agencies and governmental agencies. Official and voluntary sources of funds should be regarded as supplementing each other in their grants, payment of salaries, development of new services, strengthening of existing services, purchase of equipment, research projects, training of personnel.

## Immunization Programs Miss Many Infants

Immunization programs against diphtheria, tetanus, pertussis, and smallpox cannot be assumed to reach all of the children in a rural area during the first year of life, according to Alice B. Tobler-Lennhoff, M.D., deputy health officer of Maryland. In fact, she said, if the experience of one Maryland county is typical, they fall far short of the goal.

Every effort was made to immunize every child in rural Calvert County, Tobler-Lennhoff stated. A study showed that 59 percent of all the children born in the previous year (1952) had received partial immunization and only 44 percent had received the complete immunization course (3 injections). Tobler-Lennhoff also found that the smallpox vaccination program in this county was even less effective; only 107 out of the 412 in the study group had been vaccinated.

The immunization and smallpox vaccination status on December 31, 1953, of the 412 children born in 1952 in the study area—164 white and 248 nonwhite—are shown in the accompanying table.



During the past 5 years the county health department, according to Tobler-Lennhoff, has been conducting child hygiene conferences and has offered pediatric consultation to parents. Clinics in speech, hearing, mental hygiene, and vision are held at regular monthly intervals, in addition to a bedside program. All new parents were informed by postcard about health department facilities for their infants and given a recommended immunization and vaccination schedule.

Of the nonwhite children, 60 percent had received some immunization while only 55 percent of the white children had. However, 47 percent of the white group and only 40 percent of the nonwhite group had completed their immunizations.

Twenty-two of the white children were immunized by health department personnel and 67 by private physicians, whereas 131 of the nonwhite were immunized by the health department and 22 by private physicians. Eleven white and 65 nonwhite children were vaccinated by the health department and 22 white and 9 nonwhite by private physicians.

Of the 124 children neither immunized nor vaccinated by December 31, 1953, 24 were reported as having never been sick and having no medical supervision, according to the answers on a questionnaire. A large number, though seen by physicians for illness, rarely had checkups. The same was true for the partially im-

munized. A majority of the children were taken to their family physicians or clinics fewer than 6 times a year.

Despite intensive educational efforts, 41 percent of the children were not immunized by December 31, 1953, when ideally all immunizations should have been completed. Data not included in this study show that a large number of these children did receive immunizations in the early months of 1954.

### *Vaccination v. Immunization*

Reasons given by Tobler-Lennhoff for the difference in accomplishment between vaccination and immunization included the following:

Smallpox vaccinations are not given during the summer months; during the winter months they are often put off on account of illness.

DTP immunizations start earlier, at the age of 3 months, giving those who attend clinics or go to a doctor irregularly a better chance to get at least a partial immunization.

Absences of known instances of smallpox for many years may have engendered some indifference to vaccination.

Ignorance of the State law requiring vaccination within 1 year after birth, its lack of enforcement, and the rigid enforcement of the school law requiring vaccination before a child enters school may have led to a general belief there is no need for early vaccination.

## Technical Development Key To Child Health Plans

An effective national or international maternal and child health program must take into account the stage of technical development in a country, according to Louis J. Verhoestraete, M.D., M.P.H., medical officer, adviser in maternal and child health, Pan American Sanitary Bureau, Regional Office of the World Health Organization, Washington, D. C.

Infant and childhood mortality patterns are closely related to technical and economic advances, he found, in comparing areas of different degrees of technical development.

In areas, containing one-fifth of the world's population, the infant death rate is lower than 50 per 1,000 live births; in other areas, with three-fifths of the world's people, there are about 100 or more infant deaths per 1,000 live births.

In the technically less developed areas, the mortality pattern points to emphasis on programs that will control the major communicable diseases and improve sanitation and nutrition, Verhoestraete observed.

Excess mortality in these areas extends throughout childhood but focuses particularly on the age groups of 0 to 1 year and 1 to 4 years, the data showed. The main causes of childhood mortality are the gastrointestinal, respiratory, and other infectious and parasitic diseases, all preventable and essentially dependent on environmental circumstances.

In the technically advanced countries, the low mortality rates in the 1 to 4 age bracket reveals that environmental causes of child mortality are well under control. Neonatal mortality, less dependent on the safety of the general environment than childhood survival, has become the outstanding problem, he said.

Expansion of general health programs and development of specific maternal and child health activities are the remedial measures for the high childhood mortality in the tech-

**DTP immunization and smallpox vaccination status of 412 children born in Calvert County, Md., in 1952 on Dec. 31, 1953**

Status	White	Non-white	Total
Immunized (DTP)-----	89	153	242
Not immunized-----	48	76	124
No information-----	27	19	46
Total-----	164	248	412
Vaccinated (smallpox)-----	33	74	107
Not vaccinated-----	104	155	259
No information-----	27	19	46
Total-----	164	248	412



# FETAL DEATHS

nically less developed areas, he observed.

In recognition of probable slow development in many areas, particularly in rural localities handicapped by limited health and medical facilities, Verhoestraete suggested that the immediate programs aim at well-defined and limited objectives rather than an inclusive approach.

## Proposed Measures

He offered a number of measures that may be applied by a team consisting of a semiprofessional nurse, an untrained village midwife, a teacher, and a sanitarian, with medical advice available on a visiting basis.

Breast feeding, he said, should be accepted as the surest life-saving device in an unhygienic environment since it provides safe nutrition and reduces opportunities for gastroenteric infection.

The nutritional problems of the weaning and postweaning periods, he continued, are most important in these areas, and improved nutrition for the lactating mother will help her feed her child more successfully for longer periods. Early feeding with available animal or vegetable protein, often imperative, should be truly supplementary rather than a replacement of breast feeding at 5 to 6 months.

In preventing the spread of diarrheal disease, he said, recent evidence has indicated that quantities of readily available water for personal and household use may be more effective than a limited supply of sanitary water. This knowledge, he believes, will influence future water supply policies in rural areas.

For children with diarrhea, he suggested a treatment method that may be safely applied by semiprofessional and auxiliary nurses to reduce fatalities. Rapid dehydration is a major contributing factor to deaths from diarrhea, he said. A simple method of rehydration consists of early ingestion of water with sugar and salt or of a simple glucose and electrolyte mixture.

Verhoestraete advocated caution

in trying to promote with too much zeal the Western patterns of child rearing, which are themselves still in the formative phases.

In the fields of "harmonious growth and development," women in the technically less developed areas are not necessarily at a disadvantage, he said. Many of them seem to have a capacity for adjusting, without stress, to their pregnancy and prospective childbirth and to establish with ease stable emotional relationships with their newborn infants. In these circumstances, Western women seem, at present, to be more frequently in need of professional guidance and reassurance, he pointed out.

## Fetal Death Factors Studied in New York

Ectopic pregnancy and spontaneous fetal death occur more frequently among nonwhite women than among white women, according to a study of the 58,285 fetal deaths reported in New York City in 1952-54 (see table).

The ratio of ectopic pregnancies to 1,000 live births was 6.8 for nonwhite women and 2.2 for white women. The spontaneous fetal death ratio was 153.5 for nonwhite women and 72.9 for white women.

This study, which provides such data on a communitywide basis for the first time, was reported by Carl L. Erhardt, director of the bureau of records and statistics, and Harold Jacobziner, M.D., assistant commissioner for maternal and child health services, New York City Department of Health.

Other findings of the study are as follows:

1. Ectopic pregnancies increase in frequency with advancing age of the mother; the rate of increase is highest for first pregnancies. They decline in frequency with an increase in the number of pregnancies.

2. Spontaneous fetal deaths also increase in frequency with advancing age of the mother. However, they rise in frequency with an increase in the number of pregnancies in the young age groups (15-19, 20-24, and 25-29) and decline with an increase in the number of pregnancies in the older age groups.

3. A history of previous fetal loss increases the risk of loss in the current pregnancy. The ratio of ectopic pregnancies to 1,000 live births rises from 2.4 for women who have no history of a previous fetal loss to 9.5 for those who have had three or more unsuccessful pregnancies. The ratio of spontaneous fetal deaths increases from 66.1 for women with no history of a previous fetal

## All reported terminated pregnancies in New York City, 1952-54

Type of delivery	Number	Ratio per 1,000 reported pregnancies
All deliveries.....	548, 009	1, 000. 0
Live births.....	489, 724	893. 6
Fetal deaths.....	58, 285	106. 4
Therapeutic abortions.....	1, 512	2. 8
Illegal abortions.....	253	0. 5
Ectopic pregnancies.....	1, 413	2. 6
Spontaneous fetal deaths.....	55, 107	100. 5
Less than 20 weeks gestation.....	141, 790	76. 3
20-27 weeks gestation.....	4, 135	7. 5
28 weeks or longer gestation.....	6, 541	11. 9
Gestation not stated.....	2, 641	4. 8

<sup>1</sup> Analysis of spontaneous fetal deaths covers only those occurring before the 20th week of gestation.

death to 765.4 for women with a history of four or more previous fetal deaths.

### *Optimal Age for Pregnancies*

The data on spontaneous fetal deaths for white women indicate that there is an optimal age for childbearing, Erhardt and Jacobziner declared. The data, they said, indicate first pregnancies are desirable before the woman is 25 years old; second to fourth pregnancies, during the 10-year interval from age 25 to 34; and the fifth or more pregnancies, between the ages of 35 and 39 years.

The data for nonwhite women are less clear cut, they remarked. However, there seems to be the least fetal loss for first pregnancies when the mother is less than 20 years of age.

The sharp rise of fetal deaths with age among nonwhite women as compared with the slower increase among white women may be due to earlier effects of a higher incidence of disease and poorer nutrition among the former, they said.

The finding of a distinct relationship between previous unsuccessful pregnancies and early fetal death confirms observations of many other investigators, they noted. They advised that women with such a history and their husbands be given special attention in preconceptional treatment clinics. Both the wife and the husband should be studied, they said, since defective genes or psychological or biological disturbance of either may be a causative factor in fetal loss.

A popular misconception, she pointed out, is the belief that if a solvent or cleaner is not flammable it is safe. Stamp collectors, craft hobbyists, and insect collectors too often expose themselves to injurious dosages of carbon tetrachloride, Gleason pointed out, explaining that safety engineers have a simple recommendation for the safe use of the halogenated hydrocarbons: "If you can smell the odor, you are breathing too much of it."

She urged that amateur gardeners and farmers be made more aware of the toxic effects of nicotine and the dusts and vapors of many insecticides, such as the organic phosphorous compounds. In fact, Gleason said, it would be interesting to study the relationship of careless exposure to dangerous materials to the many tractor accidents on small farms.

Another study she thought might yield meaningful information would be a study of the causes of the falls from ladders by amateur painters. She thought that the breathing of turpentine fumes near a hot ceiling or in a badly ventilated room might be one of the leading causative factors.

Much has been done, Gleason said, to make toys for children safe, but intensified efforts by public health workers are needed to educate the adult public.

## Accidental Poisoning . . .

### **Cites Health Hazards In Home Hobbies**

Although hobbies and do-it-yourself activities have made homes more interesting places to live in, they have also introduced new hazards to health, according to Marion Gleason, research assistant in the department of pharmacology and toxicology, University of Rochester (N. Y.) School of Medicine and Dentistry.

Many toxic materials which may predispose the user to shop accidents are widely used by home hobbyists today with little or no regard to the manufacturer's warning labels, she said. Episodic or chronic exposures to many "harmless" chemical products often result in drowsiness, dizziness, lack of coordination, psychic disturbances, and impaired vision. Any of these symptoms can result in deviation from protective habits or conduct, Gleason stated, and may mean the difference between safety and serious injury.

Thousands of products, such as solvents, rust removers, paint thinners, insecticides, and fumigants, not only can cause serious injury when instructions for use are ignored, she said, but in lesser exposures are capable of bringing out less obvious accident-predisposing effects.

"Doctors are aware of the toxicology of such agents as carbon tetrachloride, nicotine, methyl alcohol, and the organic phosphorous compounds, and the injuries to the liver, kidneys, heart, and brains from the inhalation and skin absorption of such poisons are fully described in medical literature," Gleason stated. "But the symptoms of nephritis and hepatitis, obscure anemias, amblyopia, cardiac failure, and some virus infections closely resemble those of exposures to a number of chemicals in common use in homes and farms," she said. "Thus, the causative factor in the illness may be overlooked by both the patient and the attending physician."

### **Data on Poison Mishaps Do Not Show True Rate**

Accidental poisoning from farm work does not appear to be a major problem, according to L. F. Garber, M.P.H., chief of the industrial hygiene service, Missouri Division of Health, but farm safety measures designed to prevent poisonings should be improved and applied.

He pointed to advances in agricultural chemistry resulting in frequent introduction of new pesticides, defoliants, fertilizers, fumigants, and other potentially toxic products into farm operations.

Garber insisted that the signifi-

cance of poisoning as a cause of farm accidents has been minimized because of the large number of accidents resulting from farm machinery. The difficulty of obtaining adequate statistical data on farm poisonings needed to determine the relative importance of this problem is increased by the necessity of separating work accidents from home accidents and of establishing conclusions based entirely on mortality rates.

National Safety Council statistics, Garber said, show that approximately 50 percent of the 3,800 farm accident deaths occurring in 1954 were due to motor vehicle accidents, the result, in part at least, of increasing mechanization of farm tasks. Similarly, he reasoned that rapid advances in the field of agricultural chemistry and the increasing tonnage of chemicals used for agricultural purposes may result in more poisoning cases on farms.

Lack of clear definition of accident sites probably caused some overlapping so that an accurate analysis of data cannot yet be made, Garber indicated, pointing out that the International Lists of Diseases and Causes of Death excludes the "home" and "home premises" from the definition of "farm."

"There must be some overlapping between what is farm and what is home," he said, adding that "even if morbidity reports were submitted by physicians, the tendency of the small farmer to seek medical care only in emergencies, would probably affect the picture."

## Substances Responsible

Chief among the groups of compounds listed by Garber as introducing poisoning problems on the farm are the organic phosphate and somewhat less toxic chlorinated hydrocarbon insecticides. Garber discussed investigations of the toxicity of, and exposure to, these insecticides in farm work.

He cited, among others, a study of exposure to parathion and cholinesterase response in Quebec apple growers, in which it was concluded

that marginal intoxication was experienced by a group of 1 female and 32 male adults. Also, a study of 258 persons subjected to varying degrees of exposure to parathion in Washington apple orchards led to the conclusion that average cholinesterase values for those persons who were known to have had definite and consistent exposure showed significant reduction during the period of exposure.

In California, occupational diseases due to organic phosphate insecticides rose from 20 percent in 1950 to 40 percent in 1953. The California State Department of Public Health reported 391 cases of occupational disease caused by agricultural chemicals in 1954. Of 122 cases of systemic poisoning included, 101 cases were due to exposure to organic phosphates, with parathion exposure associated with 85 of the cases. Six reflected exposure to chlorinated hydrocarbons.

Other cases of accidental poisoning on farms Garber termed "miscellaneous," and listed under this heading lead poisoning among apple orchard workers, methyl bromide poisoning among fig processors, and ethylene chlorohydrin poisoning among workers treating seed potatoes. He called attention also to the condition sometimes described as "thresher's lung," resulting from the inhalation of dust from moldy hay or straw, and to cases due to familiar causes such as carbon tetrachloride used as a seed fumigant, carbon monoxide from internal combustion engine exhausts, and carbon dioxide from fermenting silage.

## Midwest Incidence

Garber felt that the problem of poisoning on the small midwestern farm is of less magnitude than that encountered in other States. An examination of farm work accidents in Kansas in 1930-51 disclosed 7 deaths from absorption of poison gases and 4 deaths by solid or liquid poisons out of a total of 1,810 deaths.

Iowa reported 24 chemical-caused fatalities and 15 deaths from car-

bon monoxide poisoning in a total of 2,181 fatal work accidents among farm residents in 1949-53, while only 4 deaths by poisoning in 245 farm fatalities took place on Missouri farms during 1952-54.

Garber was of the opinion that the greater use of seasonal and temporary employees with little or no knowledge of farm operation was one of the factors for the relatively high frequency of poisoning accidents in Western States.

## Poisoning Prevention Role Of Health Agency Stressed

Poison control activities which health departments and agencies can utilize effectively were reviewed by Ralph K. Longaker, M.P.H., chief, Home Accident Prevention Section, Public Health Service, and Charles M. Cameron, Jr., M.D., M.P.H., associate professor, University of North Carolina School of Public Health.

Official health agencies can be instrumental in reducing the number of accidental poisonings, they said. Cooperating with other groups, such agencies might determine the nature and extent of local hazards and develop professional and community education programs designed to alert the public, with appropriate emphasis on those which are seasonal or new.

Several health departments, they said, have made successful attempts to limit poisoning accidents. Campaigns in New York City and Arkansas have reduced dangers from wornout gas appliances and improper fuel oil storage, respectively.

Gases cause about half the annual 2,700 poisoning deaths. Victims of gas poisoning, which is most frequent in winter, are generally adults. Seventy-five percent of the gas poisoning deaths occur in the home.

Of the fatal poisonings from liquids or solids 80 percent occur in or around the home, and victims are usually preschool-age children. Sea-

sonal trends in liquid or solid poisoning accidents are not as pronounced as in gas poisonings, although there are apparent changes in seasonal exposure to various types of toxic liquids or solids.

More definitive epidemiological and etiological data on specific poisoning hazards in particular localities should be collected, Longaker and Cameron said. Sources for such data include death certificates and the files of local emergency clinics, police and rescue crews, physicians, and hospitals.

"If these reporting systems provide complete or representative coverage they may be developed on a continuing basis to provide a measurement of trends within the problem. They become a source of background data for the educational phases, and can be used as a means of evaluating control measures when they reflect significant decline or variation."

They believe such studies could provide health departments with working diagnoses of community problems which might be used as bases for planning measures to teach the public necessary safety techniques.

In addition to making use of public and private educational systems, home demonstration clubs, community health councils, organizations of parents and teachers, and other institutions, educational efforts should utilize the direct relationships of physicians, especially pediatricians, and professional public health personnel to the public, they said.

## Urges Coordination In Poison Control

The increasing production of new chemicals and old standbys in new combinations necessitates national coordination of poison control efforts, according to George M. Wheatley, M.D., M.P.H., third vice-president of the Metropolitan Life Insurance Co., chairman of the Subcommittee on

Chemical Poisons, American Public Health Association.

Valuable and harmless as all these chemical products are when properly used, Wheatley said, the problem is their misuse, particularly in the home.

Aspirin, kerosene, and lead poisoning are the major causes of death (fig. 1), Wheatley stated. About two-thirds of the deaths from accidental poisoning could be prevented if acetylsalicylic acid, the barbiturates, kerosene, lye, lead, and arsenic were kept out of reach of young children, he said.

Mortality from misuse of chemicals is only part of the picture. There are hundreds of nonfatal home-poisoning accidents for every fatality, according to recent data, Wheatley stated. More than one-third of the total number of deaths from accidental poisoning are among children under 5 years of age, he said. Here again the number of deaths are few in comparison with the number of serious hospitalized cases (fig. 2).

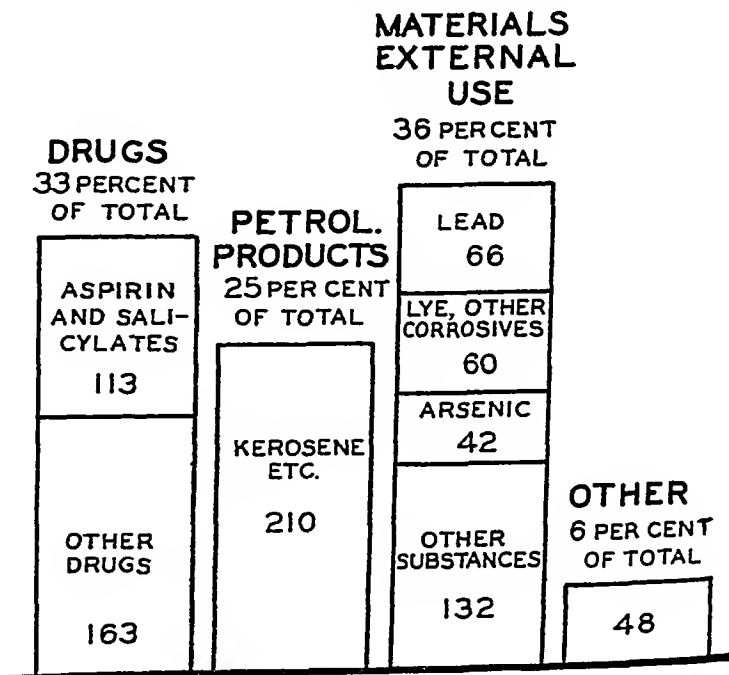
## Control Measures

Various medical and governmental groups have made efforts to control the hazards of accidental poisonings. The main Federal legislation, since the laws of 1906 and 1910, is the Federal Insecticide, Fungicide, and Rodenticide Act of 1947. This law authorizes the Department of Agriculture to require adequate toxicological information, testing, and labeling of new pesticides before they may be sold.

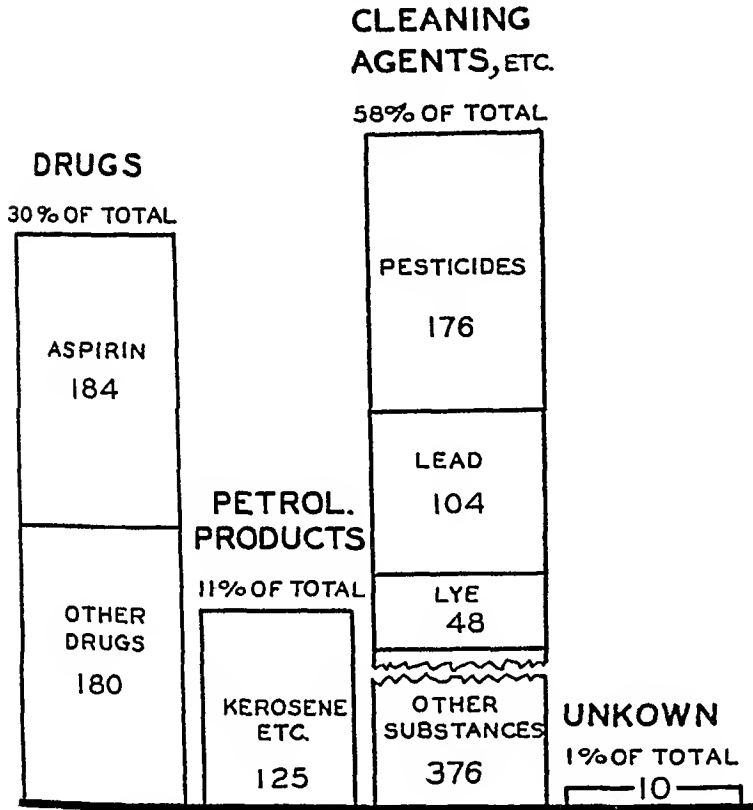
Another important poison control measure, the Federal Caustic Poison Act might be properly reviewed and broadened in the light of current conditions, Wheatley said in pointing to chemicals, which though non-corrosive, may be fatal in relatively small doses.

Recent measures by medical groups began with the American Academy of Pediatrics Committee on Accident Prevention organized in 1950. The American Medical Association's Committee on Pesticides was organized to attack the problem on a

Figure 1. Types of accidental poisoning deaths in 834 children under 5 years of age in the United States, 1949-50.



**Figure 2. Nonfatal accidental poisoning cases of 1,203 children under 5 years of age, reported by 6 poison control centers in the United States, July 1954–September 1955.**



wider front. By 1951, these two committees were working closely with the home safety conference of the National Safety Council and the Food and Drug Administration on various aspects of child poisoning. In 1952 the Lead Industries Association joined the circle along with other groups and individuals.

### Poison Control Centers

A poison control center was established in Chicago in 1953, experimentally as one element of the program of the committee of the pediatricians, which also organized committees at State and urban levels. The Chicago committee prepared a manual on the treatment and recognition of toxic agents, which has been used in cities.

The Chicago experience has served as a guide to the formation of 13

other poison control centers, Wheatley said. These centers are located in Washington, D. C., Boston, Mass., Dallas, Tex., Durham, N. C., Indianapolis, Ind., Louisville, Ky., New York, N. Y., Phoenix, Ariz., Grand Rapids, Mich., New Bedford, Mass., Springfield, Ill., Newark, N. J., and Harrisburg, Pa.

### Future Action

Recently, a Subcommittee on Chemical Poisons was formed by the American Public Health Association's Committee on Research and Standards, Wheatley said. It will give its attention to the epidemiology of chemical poisoning and to the role of health departments in this field.

The development of a clearing-house for the control activities of official health agencies is another ob-

jective. To expedite these efforts and to avoid overlapping or duplicating work done by other groups, an exploratory meeting of representatives from the official and voluntary national organizations most concerned has been sponsored by the APHA subcommittee.

The continued expansion of poison control centers will provide a way of coping with emergencies and will also serve the ultimate aim of prevention, Wheatley said.

### Laws Protect Food From Pesticides

"If all the laws are observed the hazard associated with the use of pesticides in the food processing industry is essentially nil," said Wayland J. Hayes, Jr., M.D., Ph.D., chief, Toxicology Section, Communicable Disease Center, Public Health Service, Savannah, Ga.

Sanctions on pest control in food handling industries are associated with law and consumer acceptance. The latter is the more subtle and powerful of the two, he commented. The final justification for pest control in food handling, he explained, is esthetic; the public believes that food should be clean and wholesome.

Laws on pest control and other aspects of cleanliness in food handling have, he said, several functions: to set standards of performance, which often represent a compromise; define technical details necessary to achieve the standards; establish administrative procedures; and promulgate sanctions against the small minority who might otherwise violate the regulations.

### Legal Provisions

The Federal Food, Drug, and Cosmetic Act is the main law requiring pest control in all interstate food handling industries, Hayes said. More than 80 percent of the food seizures in 1950 were made because the food contained insect parts, rodent hair or excreta, or was decomposed, he noted.

However, he pointed out, the true hazard is the addition of pesticides to the diet, or rather, for it is the addition of pesticides to the diet that is hazardous. In the United States, he noted, it is generally contended that no addition of pesticide to food is necessary or tolerable after harvesting.

Many States have laws similar to the Federal statute, he said, and various local codes supplement them. The local codes are very specific concerning floor and working surfaces, special food-handling equipment, and many other house-keeping details, he said. Sanitation, by reducing to a minimum the food and harborage available to insects and rodents, is the most important single factor in the control of pests, he declared. Nevertheless, in plants handling many tons of products there is bound to be some spillage.

The Federal Insecticide, Fungicide, and Rodenticide Act is essentially a labeling act for chemicals sold in interstate commerce to be used as pesticides. It provides for the registration of pesticides if, among other things, they are effective for the uses advocated, and they are safe when used as directed, he said.

### Hazards of Misuse

There are hazards to the operator or to the food consumer which might follow neglect of regulation. Details on the toxicity of the older pesticides may be found in pharmacology texts, he stated, and information on the toxicity of the newer pesticides is available in the Clinical Memoranda on Economic Poisons, which may be obtained on request from the Technical Development Laboratories, Communicable Disease Center, Savannah, Ga.

Although nearly all the pesticides may be fatal if swallowed, there is small chance that these will be swallowed in lethal doses except with suicidal intent, he declared. Probably the most common danger to anyone applying insecticides or fungicides is allergic reaction following direct exposure. This danger is

presented by the fact that the operator is in direct contact with the material being applied.

Parathion, a process of detoxification, and other factors, he said, are not such as to threaten the health of the operator. However, there is usually a delay of 6 hours after exposure to illness sets in.

Hayes said there was a trend toward the use of fast-acting rodenticides, such as which are slow to act but as effective as the dangerous acting agents such as sodium acetate (10-0).

He said fly baits using TE

## Mental Health

### Links Mental Deficiencies To Maternal, Fetal Factors

That there is a relationship between mental deficiency and abnormal conditions existing during the fetal and neonatal period is indicated by results of a controlled study of the birth certificates and hospital records of mentally defective children in several institutions in Baltimore and in two Maryland institutions for mental defectives, reported Abraham M. Lilienfeld, M.D., and Benjamin Pasamanick, M.D.

Dr. Lilienfeld is chief, department of statistics and epidemiological research, Roswell Park Memorial Institute, Buffalo, N. Y., and Dr. Pasamanick is professor of psychiatry and director of scientific research, Ohio State University College of Medicine, Columbus, Ohio. The studies

show that the incidence of mental deficiency is higher in children born to mothers who had mental deficiency during pregnancy or during the neonatal period than in children born to normal mothers. However, the relationship between maternal mental deficiency and fetal mental deficiency is not clear.

Risk of mental deficiency increases, particularly in young mothers, manick said.

medicine, which speaks of a "healthy person in a healthy society," and which is based on sounder logic, Foster thinks, than a "healthy mind in a healthy body."

## Long-Term Research

Foster noted a lack of cooperative specialization, on the part of the sciences and professions concerned with family life, in understanding the etiology of individual and social problems. He told how professional unionism among the organizations most concerned with family life led them to function as pressure groups and to include as members only those who met certain standards. These agencies, because of their fragmentation, are not helping the family do its important job of child rearing and maintaining itself as a unit over a long period of time, he commented.

"We need to set up centers to study how to get mental and other health practices incorporated into the daily living of everyone in our society," he urged. He suggested evenly distributed financial support for research, training, and treatment, and that, as the middle step between research and application, long-time projects be conducted over several generations. These might help demonstrate how individuals, through family experience, can grow up to become mature, mentally and physically healthy people; how the resources of the community can be analyzed and used to further the objectives of better health through education; and how existing organizations and the community can utilize the results of such effort.

## Health Service Improved Through Group Learning

The use of a teaching experience which was part of the day-to-day program of a local health department, to improve a health service while the service was given, was described in a discussion of group learning in mental health practice.

The 5-year group project in the well-baby clinics of the Louisville

and Jefferson County Board of Health, Louisville, Ky., served as the basis for the discussion presented by Marie Goik, R.N., M.S., nursing consultant, United States Children's Bureau, San Francisco, Calif., and Henry H. Work, M.D., associate professor of psychiatry, University of California Medical Center, Los Angeles, Calif.

Objectives of the Kentucky mental health study, they said, were to improve methods of teaching physicians and nurses, to integrate general public health nurses into teaching programs, and to present methods of caring for mothers and babies so that clinic services were supplemented by mental health values. The study proved the value of the technique in intensifying and consolidating learning experiences, they said.

Students included graduate and student nurses, medical students, and residents in pediatric training. The teaching staff consisted of a pediatrician-psychiatrist, a psychiatric social worker, and a public health nurse trained in mental health nursing, they stated. Consultation services of a psychologist and a nutritionist were available. Administrative personnel participated in the planning, thus facilitating decisions as to time and personnel allocated to the project.

The major teaching effort was directed toward the training of residents in pediatrics and the public health nurses who worked in the well-baby clinic. Seminars for each group were held over a 1-year period to give the students a general understanding of the growth of a child and the mental health problems of mothers and children, Goik and Work stated. Courses in personality development were included for all students.

The seminars were held concurrently with the clinics. Students were separated according to disciplines and teachers were matched to the student groups. In the early seminars, there was a tendency to underestimate the students' knowledge; later periodic review was re-

quired to determine if instruction was proceeding too fast, they said.

Seminars demonstrated individual physical and psychological development and the relationships established during growth. Case examples and audiovisual material were used and, whenever possible, clinic cases were linked to mental health films illustrating the principles involved. Films were chosen which might aid the students to understand the cases seen in the clinics.

Since it was not possible for formal teaching to precede practical application of knowledge, difficulties encountered in the clinic were discussed in the seminars, they said. This enabled the teaching staff to modify its work so that principles were more closely linked with practical application.

## Clinics

The actual operation of all well-baby clinics in the Louisville and Jefferson County Board of Health was entrusted to graduate nurses, Goik and Work said. Assignment of pediatric residents to individual clinics for 6-month periods enabled the residents to become acquainted with clinic personnel and with the patients.

A member of the teaching staff was present during the physician's examination or worked with the nurse in her direct contact with the patient, they reported. Such observation of treatment, examination, or technical procedure resulted in a better appraisal of the student's clinical approach. It also gave the instructor an opportunity to evaluate the patient and to assist the student in contacts with patients, teaching the student the value of giving attention to minor and seemingly unimportant comments of patients.

At the close of each clinic, the teaching staff, the residents, and the nurses discussed the patients and the treatment procedures, they stated. Later, members of the teaching staff might accompany the nurses, at their request, into the patients' homes.

### Postclinic Conferences

Postclinic conferences brought together the accumulated knowledge of students from all disciplines. It provided for discussion of the patients and the reactions of the members of the group to one another, Goik and Work stated. The teaching team tried to keep the discussions patient-centered. Even when personal needs of the students arose,

the teaching staff used examples of similar situations among patients and fellow students instead of centering the discussion on the student involved, Goik and Work stated.

In these conferences, they said, both physicians and nurses learned how to deal with various types of clinic patients. The teaching team was able to improve understanding of physicians and nurses for each

other's difficulties and to help the patients. Nurses and physicians in turn presented cases to the group and shared their experiences and feelings. Having all student groups represented in the conferences facilitated teaching and assistance to the patient as well as understanding between representatives of the disciplines on the teaching team.

## Mental Health Section Established

Giving action to the theme of the 1955 conference—Where Are We Going in Public Health?—the governing council of the American Public Health Association established a new APHA section on mental health when it met in Kansas City.

Establishment of the new section recognized the need for intimate integration of mental health within the structure of the American Public Health Association. Chairman of the section is John D. Porterfield, M.D., director, Ohio State Department of Mental Hygiene and Correction, Columbus.

Prior to the meeting of the governing council, two regular program sessions and a luncheon were devoted to mental health needs within public health services.

The luncheon meeting was addressed by Leonard A. Scheele, M.D., the Surgeon General of the Public Health Service. Dr. Scheele traced the developments in mental public health of which the formation of the new section was the logical conclusion.

In the program sessions, papers were presented on the social drift of schizophrenia patients, the distribution of elderly adults in the population, and their health and mental health problems.

Two other papers took up the subject of mental deficiency: One dealt with its distribution in a county, and the other with the relationship between the hypothesis of fetal wastage and mental deficiency. Another paper discussed prematurity and its relationship to mental deficiency and various neuropsychiatric conditions.

Certain of these studies will appear in forthcoming issues of the *American Journal of Public Health*, and others have been included in the news coverage of

the annual APHA conference appearing in this issue of *Public Health Reports*.

Other activities at the conference reflected the growing concern for coordinating mental health and public health activities.

A full session of the APHA public health nursing section listened to a panel discussion, led by Ira V. Hiscock, Sc.D., on the role of the public health nurse in mental health.

The Committee on Research and Standards heard and accepted a report on mental health.

The Committee on Administrative Practice established a subcommittee on mental health. The committee, like the governing council, is one of the basic policy groups in the association. It is responsible for many of the publications issued by APHA.

Other officers of the new section are: Paul V. Lemkau, M.D., vice chairman, New York, and Rema Lapouse, M.D., secretary, New York. Members of the section council are Dorothea Dolan, M.S.W., Illinois, Ernest Gruenberg, M.D., New York, Morton Kramer, Sc.D., Maryland, Benjamin Pasamanick, M.D., Ohio, and Ruth Simonson, R.N., New York.

The mental health section welcomes as members all who are interested in the epidemiological and administrative problems of mental health services for the public.

Application blanks for membership in the American Public Health Association may be obtained from the headquarters office at 1790 Broadway, New York 19, N. Y. Membership in the mental health section may be requested at the time of writing the application.



# School Health Practices . . .

## Find Familiar Sounds Test Best for Preschoolers

The University of Denver Hearing Center is recommending that health departments try the center's adaptation of Glorig's familiar sounds technique when they test the hearing of young children.

A pilot study, reported by the director of the hearing center, Marion P. Downs, M.A., has shown that a dog's bark, an auto horn, a telephone bell, and other familiar sounds are more readily identified by children 2 to 5 years old than are the unfamiliar tones heard in the individual pure tone sweep check.

The familiar sounds test introduces a technique which had not been attempted in the screening of hearing for diagnostic purposes until it was tried in the Denver study.

The test answers the long search for a preschool screening device by investigators concerned with the importance of full hearing during the child's formative period of language development, Downs said. The diagnostic value of the pure tones is retained by virtue of filtering each sound in significant frequency band widths.

When applied to 350 3-year-olds in the survey, the familiar sounds test found a larger percentage of medically preventive cases and was easier and faster to administer than the pure tone test, she reported. Only 18 did not cooperate. The other children responded so well that the test is recommended for case finding in the first 2 grades and among preschoolers. Screening time need take only 2 minutes for each child if orientation is given in pre-screening sessions rather than during the actual testing.

The individual pure tone sweep check is the only pure tone test which can be presently relied on for good results for kindergarten through

second grade, Downs said. It also requires a technician well trained in audiometry with children. The Massachusetts test, the Glorig audiometer, and the Reger-Newby audiometer provide fast group screening methods from the third grade on, she noted.

Now that these tests, including the familiar sounds test, offer reliability for school use at all grade levels, it remains for health departments to pursue hearing programs with proper otological and educational followup, Downs concluded.

### *Preschool Study*

In the Denver study, a series of familiar sounds were recorded after being filtered into fairly narrow frequency band widths. For example, a dog's bark as recorded contained only the frequencies 1,000 to 2,000 cycles per second. Two sounds were recorded at the 250-750 c.p.s. band width, 2 at the 1,000-2,000 band, and 2 at the 3,000-5,000 c.p.s. band width. The band widths were considered sufficiently diagnostic for medical purposes.

The child first heard the sound at a loud level of 50 decibels. He was then asked to point to a picture representing the sound. One sound at each band width was presented to each ear. He was then told to listen while the sound was repeated at 15 db. When he failed to indicate that he could hear at any one band width, he was rechecked.

In addition, the child was also given a pure tone sweep check at 15 db. and told to raise his hand on hearing a tone. Any failure in either screening technique was later retested by a clinical threshold audiogram. On-the-spot threshold tests were given at random to 1 out of every 5 of the 350 children. Reliable responses were obtained on every retest.

Eight percent of the children were

found by the threshold tests to have significant losses of 15 db. or more. Of this 8 percent, 96 percent failed to pass the familiar sounds test whereas only 3 percent had failed the pure tone screen. The familiar sounds test missed only 4 percent of the children with significant losses while the pure tone test missed 61 percent. The incidence of unnecessary rechecks was lower for both tests than is normally expected: 5.6 percent of the children found to have normal hearing in the threshold tests did not pass the familiar sounds test as compared with 2.4 percent by the pure tone screen.

Of the 25 final failures, medical reports were obtained on 20, 14 from otologists and 6 from pediatricians. The reports confirmed the presence of ear pathologies. Eleven of the failures have received medical treatment and followup audiograms. Although the followup is still in progress, 3 have been restored to perfectly normal hearing.

## A Healthful Environment Is School Child's Right

A good mental health program, healthful physical surroundings, health education in the school, and adequate health services in the school and community should all be a part of the school child's environment, according to Marie A. Hinrichs, M.D., Ph.D., director, bureau of health services, Chicago Public Schools, Chicago, Ill.

Although each has its separate part, the home, the school, and the community share responsibility for providing a healthful environment for the child, Hinrichs said. The home prepares him for his school experiences. If he has been taught respect for authority, for the dignity of work, and for the rights of others, if allowance has been made for his shortcomings, and if his failures have been accepted with understanding, it will be easier for him to move on to the larger environment of school, Hinrichs stated.

## Home and School

Both home and school are working toward the development of a healthy, happy adult who will work for the creation and maintenance of a desirable community for himself and his family. To function effectively, the home and the school must work together, she said.

Parents, teachers, and administrators can all contribute toward providing a "healthful emotional climate" for the child, Hinrichs stated. A wise administrator will sponsor a curriculum of healthful living, with emphasis on day-to-day problems rather than on academic subjects, and an understanding teacher will be a child's most frequent counselor and guide.

Conferences with parents as part of the teaching plan will bring about the most effective results in health education, and joint planning in all areas will make for rapid and lasting progress, Hinrichs asserted.

## Community Responsibility

The effectiveness with which parents, teachers, and school administrators present their problems to civic leaders will determine the degree of community acceptance of responsibility for health and safety, she stated.

Community responsibility for health and safety includes adequate fire and police protection; traffic control; inspection of buildings for structural stability and safety of stairs; sanitary control of community water supplies, their use, and the disposition of dissolved or suspended wastes; and supervision of garbage and refuse disposal, lighting, heating, and ventilation, Hinrichs said. The hazards of working with complex machinery and the danger connected with the use of atomic energy should be kept constantly in mind, and possible causes of accidents should be sought and removed.

Although these are community responsibilities, Hinrichs said, competent individuals in the home, the school, and the community should be

alert to detect and report any deviation from accepted standards in these areas.

In conclusion, Hinrichs said that recognition of the need for joint support of the school health program by all segments of the environment—the home, the school, and the community—will be the most effective means of promoting the health of the school child.

## Norm Selection Is Important To Health of School Child

School health workers measure the growth of children to describe characteristics, to identify undesirable deviations from normal, and to select children for special study, stated Howard V. Meredith, Ph.D., professor of physical growth, State University of Iowa, Iowa City.

Care should be exercised in selecting standards, or norms, of growth, Meredith said. It is important to recognize the differences between norms for description, for appraisal, and for screening, he emphasized. School health workers should be able to turn records of height and weight into interesting information on growth and into useful aids in health appraisal.

## Descriptive Norms

A descriptive norm should not be confused with norms for appraisal or evaluation, Meredith continued. For example, a norm may be constructed to describe the height status of a group of schoolboys, all of the same age, in a particular geographic area. Records of the boys' measurements are first arranged in order, from the shortest to the tallest, and then divided into categories at the 10th, 30th, 70th, and 90th percentiles.

Using these specifications, it can be determined whether a boy is tall, moderately tall, average, moderately short, or short. Such a norm is valuable for description, but it does not provide a basis for determining whether a boy is undesirably tall

or whether he is retarded in height, Meredith pointed out.

## Appraisal Norms

Norms for appraisal, or evaluation, are used to determine "whether the organism is satisfactory or unsatisfactory, fit or unfit, healthy or below par," Meredith stated. Such norms are more difficult to construct than norms for description.

Before constructing appraisal norms, investigations must be made to determine the relationship between "what is valued and what is projected for normal use," Meredith stated. In connection with height, information would be needed on such points as the consistency with which a slow increase in height is associated with the onset of disease; a rapid increase with low resistance to fatigue; and an average increase with deficient diet or frequent illness or both.

Information would also be needed on the degree of association between the rate of increase in height and nutrition, endocrine function, and physical activity. Few controlled investigations of this type have been made, Meredith said.

## Screening Norms

Norms for screening do not appraise but they do more than describe. "In essence, they represent the joint utilization of two or more norms for description in ways suggested by clinical experience," Meredith stated.

Clinical observations indicate that screening in terms of growth characteristics is valuable but that slow growth or slender build do not necessarily indicate poor health, he said. Body measurements are "fruitful adjuncts to the medical examination of school children," and the use of screening norms brings to the attention of school authorities children whose health deviates sufficiently from normal to justify a medical examination to determine whether their health is satisfactory or whether they need treatment.

### Selecting the Norm

School health workers usually select norms constructed by others instead of constructing their own tables and charts, Meredith said. They should choose norms that will describe and screen rather than appraise and that will portray in correct perspective the growth characteristics of the pupils with whom they deal, he stated.

It is important that measurements of height and weight be carefully taken and that norms be accurate and up to date, Meredith said. In this connection, he called attention to the fact that school children today are taller by several inches than school children in 1900 and that, in girls, this more rapid development in body size has been accompanied by earlier appearance of the menarche.

In conclusion, Meredith said that norms provide the school child with a record that accompanies him from grade to grade, they furnish the health education teacher with resource material on individual variation in growth, and they bring deviations in growth and progress to the attention of school personnel.

### Suggests Economical Ways To Improve Ventilation

With an accumulating backlog of school construction and insufficient funds to meet even basic needs, Constantiu P. Yaglou, M.S., professor of industrial hygiene, Harvard School of Public Health, urged that every legitimate measure be taken to cut school building and equipment costs.

Health requirements and codes for ventilating schools are not keeping pace with school construction, Yaglou said in discussing possible savings that can be made by simplified systems.

The fresh air requirements, according to Yaglou, have traditionally been based on the quantity required to dilute offensive odors to an ac-

ceptable concentration. Recent attempts to replace this criterion with one based on bacterial counts have not been completely successful. Yaglou added that no definite relation has yet been shown between sanitary ventilation based on bacterial counts and the spread of acute infectious diseases in occupied rooms, with the possible exception of measles and chickenpox.

The incidence of upper respiratory infections in Navy training station barracks was related not to the floor area or cubic space allowed per person, but to the number of persons housed in a room, Yaglou said, in recalling a World War II study. However, the study was not adequately controlled, he said, and therefore, the influence of other factors was unknown.

### Problems and Suggestions

The overheating of buildings by solar heat is primarily an architectural problem, Yaglou said. He was of the opinion that the high volume of air change required for controlling solar overheating can be reduced at least 50 percent by the use of suitable overhangs and other shading devices, by substitution of heat absorbing glass for ordinary glass, and by improving distribution systems so as to handle air colder than 55° F. without causing drafts. Any rigid specification of air supply above the minimum needed for odor control is meaningless and has no place in statutory codes, he stated.

Automatic regulation of radiators and convectors is also essential to control overheating, he said, especially in rooms subjected to varying solar loads. He also favored a certain amount of variability, not exceeding 2° F. ±, the comfort level to exact temperature controls.

Since comfort and health are affected by drafts and steep vertical temperature gradients, he recommended that the air movement be kept below 40 feet per minute and the vertical distribution of tempera-

ture be controlled at 1½° F. per foot of height in the occupied zone.

The drawback to using jacketed space heaters in rural schools, Yaglou said, was the stratification of the cold air at the floor and overheating in the breathing zone. Studies showed that New York State rural schools using this inexpensive heating method had a much higher absentee rate from respiratory illness than the city schools.

He said that either the lower cost window-gravity systems or the more expensive mechanical ventilators have shown equally good results as far as respiratory disease incidence is concerned. The positive ventilation provided by the unit ventilator in all weather conditions is its main advantage, he said, but it is higher in cost, produces fan noise and some drafts, and requires servicing of motors.

Yaglou said significant savings could be realized by finding a substitute for vent flue exhausts required by law. A less objectionable substitute is a small fan-motor unit that would exhaust the used air from individual classrooms directly to the outside through a hole cut in the wall and equipped with check louvers. Such a unit, he pointed out, can be used with mechanical or modified window-gravity supply systems without encroaching on fire regulations. Smoke, in case of fire, would be ejected at the source.

Yaglou said the recent trend toward one-story prefabricated steel schools offers good possibilities for simplified ventilating systems. Standardization and elimination of costly fire-escapes, fireproofing, stairways and stair halls, duplicate toilets and extra exits, are among the economies offered by this type of construction. Properly designed for the climate, the one-story structure is particularly adaptable to suburban residential districts, he said, but he doubted that it was the best investment for congested city districts. Other savings Yaglou cited could be effected by reduction of ceiling heights, and adaptation of a single

all-purpose room combining auditorium, playroom, and cafeteria functions in elementary schools.

### *State Ventilation Regulations*

There are now 18 States, 1 more than in 1930, having no codes governing the heating and ventilation of public schools, he reported. Nine States have general provisions stipulating only "adequate" heating and ventilation. The remaining 22 States, 1 less than in 1930, have statutory or State board regulations specifying various requirements.

The 22 States exercising controls require a minimum fresh air supply of from 10 to 15 c.f.m., instead of 20 to 30 c.f.m. as was common in 1930, for class, study, and recitation rooms. Eight of these 22 States require that the total air supply (outside plus recirculated air) must not be less than 30 c.f.m. per pupil, a standard that Yaglou said could not be met without the use of fans.

New York regulations for heating and ventilation, as amended in 1947, are the most rational and up to date in his estimation.

New York State requires that heating systems be designed and guaranteed to maintain certain specified temperatures in different sections of the school, with a vertical gradient not exceeding 5° F. from the floor to the 60-in. level. The ventilating system must provide a minimum air change of 10 c.f.m. per pupil to remove odors without producing drafts. The air movement in zones of occupancy must not exceed 25 f.p.m.

For effective thermal operation in mild weather a design factor of 15 c.f.m. is recommended. When extensive use of a school building is anticipated in hot weather, the department may require installation of an air conditioning system or the use of electric fans. Independent ventilation systems are required where toxic substances or strong odors are produced. Authority to approve places and specifications for school buildings is vested in the commissioner of education.

## **Urges More Rigid Control Of School Lunchrooms**

School lunchrooms should be included in the food sanitation programs of the city and county health departments in the opinion of John H. McCutchen, M.P.H., director of the bureau of food and drugs, Division of Health, Jefferson City, Mo.

Further, school lunchrooms should be issued permits and grades as any other eating or drinking establishment in the community, and violations of regulations should be dealt with in a similar manner, he said.

In Missouri, McCutchen said, the department of education reviews all school building plans before State approval is given for State aid. This does not cover all the school lunchrooms being built throughout the State, but a large percentage of plans for new lunchroom facilities come in for review in this way. McCutchen stated that in many instances defects in plans have been corrected.

One of the major problems, McCutchen stated, to be encountered is the lack of adequate space for the preparation and serving of food. Space for separate facilities has not been allocated in many existing schools. The usual result is that space now used for storage and other purposes is converted into food preparation rooms since overcrowded classrooms have taken up all other available space.

The first of two resulting problems is inadequate hot water facilities. Hot water heaters cannot be made to produce the desired hot water for rinsing dishes by simply turning up the thermostat or attaching a booster heater, McCutchen emphasized.

Every hot water heater is designed to operate at a definite B.t.u. input and the upper limit of the thermostat should not be exceeded, he explained. The recovery rate of such hot water heaters should be determined mathematically beforehand. School authorities should try to determine how much hot water will be

needed and how much space is available before proceeding with construction plans.

### *Cites Defects*

Inadequate illumination is the second problem in McCutchen's opinion. He said it has been found that the degree of sanitation is directly proportionate to the amount of properly distributed light. Without adequate light, the lunchroom employees cannot tell when the equipment and facilities need cleaning or whether they are actually clean after being washed.

McCutchen said that these are some of the other defects in lunchroom construction plans: no specifications for kitchen equipment; grease-resistant asphalt tile not specified; inadequate space for kitchen and storeroom; no walk-in cooler, insufficient refrigeration capacity; soiled-dish window too small; no clean-dish tables; dining area too small; lack of adequate hand-washing facilities; improper location of toilet facilities; failure to provide a sneeze shield for cafeteria lines.

McCutcheon contended that the local health department and the school administrators are responsible for providing adequate space for the kitchen and dining areas, proper equipment, and proper construction. To assure proper sanitation, school administrators should consult with the health department about building plans before commencing construction.

To assist the school officials and the employees of school lunch programs, Missouri conducts food handling courses. Junior and senior classes of the high school are also invited to participate in this training course. When the students learn the proper sanitation procedures, McCutchen said, they demand them and are quick to criticize improper techniques in public establishments. Many also tell their mothers about the proper methods of handling food, cleaning, and sanitizing dishes and equipment.

## School Dental Results Questioned by ADA

School health programs that fail to bureau of improved dental health should be reviewed periodically according to Perry J. Sandell, M.Ed., director of the bureau of dental health education, American Dental Association.

Sandell reported that in 1955 the bureau of economic research and statistics of the association sought to determine the number of cities having school dental programs and the characteristics of these programs. Completed questionnaires were received from 2,228 cities (63 percent) with populations exceeding 2,500.

### Dental Personnel

Ninety-five schools (7.1 percent) had the services of a full-time dentist. In 83 percent of the cities, dentists worked part time; of these, 43 percent donated their services.

Full-time dental hygienists were employed in 22.1 percent of the reporting schools. Dental hygienists, employed on a part-time basis, were reported by 11.7 percent. Of these, about one-fourth donated their services; the others were paid by various organizations.

### Services of Dentists

Mouth examination was the most frequent service. It was included in the reports of 74.1 percent of the responding cities. Annual examinations for all students were reported by 25 percent, annual examinations for certain grades only were held in 38 percent, and examinations at irregular intervals were made in 10 percent. Only 21 percent of the cities referred students to their own dentists for complete examination.

Some dental treatment was provided in 60 percent of the school systems. Fillings and extractions were provided upon request in 10 percent of the cities. In 8 percent of the cities, topical fluoride treatments were provided for certain age groups.

### Services of Hygienists

Dental hygienists made annual dental inspections of all children in 13 percent of the cities, whereas in 16 percent they made annual inspections in certain grades only. In half of these schools, children were referred to their dentists for examination. Prophylaxis was provided by the dental hygienists in 18 percent of the reporting cities and the median amount of time spent was 40 percent. In 20 percent of the cities, hygienists gave topical fluoride applications and devoted 40 percent of their time to such treatment.

### Educational Activities

In 27.1 percent of the cities, dentists served as consultants to teachers in their health instruction programs; in 14 percent they appeared before classes to speak on care of the teeth.

Hygienists served as consultants and aided in inservice training of teachers in 18 percent of the cities. In 20 percent, they taught dental health in the classroom, part time. Followup visits to the home were made in 18 percent of the cities.

### General Observations

Unless dental inspection succeeds in determining dental health status and in motivating the child and parents toward better dental care, Sandell stated, the value of inspection is doubtful. He said reports show that dental care is lacking for many children, which indicates that dental examination alone does not guarantee dental health.

Sandell urged that procedures used in developing an inspection program and the functions of specialized personnel be analyzed carefully so that the educational potentialities can best be utilized.

### Dental Health Education

Sandell commented on various approaches to dental health education, with reference to a survey of opinions and experiences of dental directors. In one instance, a director promoted a graded course of study in dental health and a parent education

program designed to stimulate interest in fluoridation. Still another suggested an X-ray survey program, comparable to that of the tuberculosis survey, with an educational program to precede and to follow the survey, as well as a followup program to bring pupils in for treatment. Some schools have begun inservice training programs for teachers. Others reported success in programs using science classes to conduct Snyder tests for dental caries susceptibility.

The parent-teacher association in one State has recognized the importance of education of the parents in dental health by establishing a study course in dental health for all local units of the association. These were developed with the assistance of the health department and the dental society.

## Schools Can Aid In Fight Against Poison Mishaps

An organized attack by educational institutions on the problem of accidental poisonings has been proposed by Fred V. Hein, Ph.D., consultant in health and fitness, bureau of health education of the American Medical Association.

Schools should contribute, said Hein, to the prevention of such accidents through the following: (a) use of existing adult education channels, including home-school organizations such as parent-teacher associations; (b) emphasis on preventive procedures throughout the school careers of children and youth; (c) stressing such measures in high school and college courses relating to the education of prospective parents.

Institutes, classes, study groups, meetings, forums, and conferences for adults on many subjects might appropriately include information on poisoning hazards and prevention, he said. The same applies to educational radio and television, newspaper articles, periodicals, and bulletins to homes.

More than 30 million children alerted in school to poisoning dangers might function as salesmen for safety, Hein stated. In the lower grades such training could be given to children in the form of simple "do and don't" instruction integrated with regular activities of the school day. As children gain understanding they might be taught the "how and why" of safe practices with regard to the handling of potentially poisonous substances. Hein pointed to the many opportunities for teaching of accidental poisoning prevention along with other subject areas in the secondary school curriculum, such as

classes in health, industrial and fine arts, science, and homemaking.

Prospective parents have often been neglected in educational efforts designed to enlist the cooperation of families. Yet many secondary school and college students will become parents in the near future. When they have actually become parents, only a portion of them can be reached, and then only indirectly, Hein stated, concluding that it was especially important that these older students be made aware of accidental poisoning hazards and of opportunities for taking adequate safety measures.

promotion of a better dental program.

4. To encourage the observance of proper dental health practices including personal care, professional care, proper diet, and oral habits.

5. To encourage better patient-dentist relationships.

6. To present how the dental health activities may be correlated with the public health program.

7. To educate the public to the value of adequate dental care for children and youths and to develop the resources that make such programs possible.

8. To continue to promote better education programs in colleges and universities for prospective teachers of health education.

9. To encourage and emphasize the need of public health courses for the undergraduate dental students so they might be better prepared to participate in their community's dental program.

10. To interpret the dental program to the practicing dentists and stimulate their interest and responsibility.

## Dental Care and Services . . .

### Long-Term Dental Health Via 10 Short-Term Goals

Too few parents consider the condition of the child's teeth until he is ready to enter school and then usually as a result of the dental educational feature of the summer roundup program, remarked William A. Jordan, D.D.S., M.P.H., chief, section of dental health, Minnesota Department of Health, Minneapolis.

Overcoming this indifference in ourselves as individuals and as parents, stimulating the leadership of the dental profession in their own segment of health education, and sparking the interest of legislatures in the reasons for good dental health are the major foci of dental health education, Jordan continued.

The family dentist misses many opportunities to contribute to dental education, Jordan believes. When he says to his patient, "Sugar causes tooth decay," that is the occasion to describe how decay is created through the process of oral bacteria feeding on sugars in the mouth, producing an acid which attacks the

tooth enamel. It is an opportunity for him to tell how fluorides ingested or topically applied can create resistant tooth enamel.

Too often, particularly with fluoridation programs, the opposition has done a better job than the proponents, Jordan observed.

#### Short-Term Objectives

Jordan listed short-term objectives which he feels are within the realm of achievement, and added that of the methods for attaining them the most needed are undergraduate public health courses established in all schools of dentistry; courses in dental health required for public health nurses; and improvements in health education material presented to undergraduate teachers. His list of objectives included the following:

1. To teach every individual the importance of keeping his mouth healthy throughout his lifetime.

2. To understand the important relationship of dental health to general health, outward appearance, and even mental reactions.

3. To relate the services available from all groups and agencies in the

### Can Extend Dental Services With Auxiliary Personnel

Because of the shortage of dentists, a realistic staffing plan for dental public health programs should depend on auxiliary personnel to extend services, according to Norman F. Gerrie, D.D.S., M.P.H., acting chief dental officer of the Public Health Service.

Many dental health program functions can be performed by available auxiliary personnel such as dental hygienists, health educators, and public health administrators, he asserted.

The demands on the public health dentist have increased with the growth of technical and administrative knowledge in the field so that the dental public health administrator is pressed to keep up with his work, Gerrie declared.

It is his responsibility to plan the dental program, and to integrate and coordinate it with the other activities of the health department, he said. He should be designating and defining dental needs of the community, selecting objectives and assigning priorities, working with dental organizations of the area, and making sure that the quality of the work in the dental program earns public respect and appreciation. In this task few dental administrators can hope to have public health dentists as assistants, he said.

This, he explained, is because: (a) the national supply of dentists is known to be inadequate; (b) since dental public health has achieved specialty status, expensive training after regular training is required; (c) dental schools orient their students for private practice, which is much more lucrative than public health dentistry; and (d) the demand for public health dentists has risen steadily since 1918.

## *Suggested Criteria*

In the past, auxiliary personnel were selected because they were more readily available and less expensive than dentists, were already in the field, or were trained in fields which enabled them to bring to the dental program skills of potential value. Such personnel were employed with varying degrees of success, he commented.

Useful criteria for choosing auxiliary dental personnel, Gerrie suggested, are that the individuals considered should: (a) have adequate basic preparation for the job; (b) have public health training, either a year in a public health school or integrated training during the basic preparation; (c) be available in adequate numbers or such availability promised; and (d) be acceptable to the public in their job capacities.

These criteria, he declared, point to health educators, dental hygienists, and public health administrators as acceptable auxiliary personnel.

## *The Three Groups*

Health educators bring skills particularly valuable in dental education programs and in the use of printed materials, in work with community organizations, in conducting workshops and inservice training programs, he said.

The adequately trained dental hygienist with a degree is more useful to the program than is the 2-year hygienist trained primarily in clinical operations, Gerrie noted. Hygienists have been employed for lectures to students, teachers, and parents and could conduct surveys for the dental administrator. They can give classes in dental health for teachers and nurses. In community planning, the hygienist could coordinate action with the health educator; each may act as a resource person for the other. The hygienist can double for the dentist except in activities involving technical interpretation.

The public health administrator brings to his job knowledge of public health philosophy, techniques, methods, and related elements of all public health disciplines. He can contribute to planning and evaluation. He could develop procedures for surveys and prepare preliminary drafts for the required administrative reports.

## *Research Needed*

Auxiliary workers with other skills may be used as new needs arise. Research is required to identify such skills and a knowledge on the best methods of training personnel. A willingness to try to discover the best uses of auxiliaries may lead to a significant easing of the shortage of manpower in the field, Gerrie asserted.

## **Long-Term Dental Survey Advantages Reported**

A long-term study of dental caries incidence and periodontal disease in Prince Georges and Montgomery Counties, Md., has provided findings

which could not be obtained from a cross-section survey, according to A. L. Russell, D.D.S., M.P.H., of the National Institute of Dental Research, National Institutes of Health, Public Health Service, Bethesda, Md.

The long-term procedure yields information which can be elicited by no other techniques, he said. "A principal advantage of the method is that any observation can be analyzed as a mean change and hence is amenable to any desired dissection by statistical analysis. The uncertainties of dealing blindly with absolute values are avoided."

Some of the types of data which are accessible only through long-term examinations were illustrated in the findings of the chronic oral disease investigation in Maryland. These types were: the direct estimation of incidence, increment over a given time span, with known error components; the relationship between two effects which are observed rather than assumed to coexist through the period of study; and the retrospective study of persons in whom a given effect appears, compared with similar persons in whom the effect did not appear, based directly on data of record.

## *The Maryland Study*

The study began in 1951 when the National Institute of Dental Research was invited to participate with the Southern District Dental Society of Maryland in a prefluoridation survey of dental caries. A long-term study was conducted in which 5,000 to 6,000 elementary and junior high school students were examined during the same calendar week each year, Russell said.

A method was devised for scoring periodontal disease from zero to 8.0 with the higher scores indicating more severe damage. The mean numbers of decayed, missing, or filled permanent teeth permitted scoring over a continuous scale for dental caries.

Comparison of caries activity and gingival status for the observation period revealed a tendency toward



increasing caries activity with increasing gingival inflammation for children with only simple gingivitis. There was an unusually large number of children with clean mouths in 1955 who had shown simple gingivitis in 1954. About 8 out of 9 with such reversals exhibited objective evidence of professional care during the study period. Such care had been received by only about 2 children out of three for the entire group.

Children receiving care during the year or showing no need for care at the beginning and end of that period showed a very low prevalence of gingivitis, according to Russell. Definitely more gingivitis was seen in a small group which received only emergency treatment. The remaining children who did not receive care

were grouped into three categories roughly representing the degree of neglect of care.

In this grouping, children whose care needs had been met at the outset of the period, but who had not yet received treatment for lesions appearing during the year, showed the least gingivitis. Intermediate were those in whom generally small carious lesions, present at the beginning of the year, received no treatment during the 12 months. Children who exhibited gross neglect had the most gingivitis.

Russell pointed out that the long-term survey is not the method of choice in studies where the data required may be obtained directly through a single cross-section survey.

His co-workers believe that the method warrants further study from the standpoints of both theory and practical application. Few physicians are willing to take part in morbidity studies, they said, and those who are available usually require a period of orientation to population studies, whereas interviewers can be found in any community and can be trained by the study staff. Use of interviewers for these studies is much less costly than the use of physicians, and many more persons will reply to an interviewer's questions than will undergo physical examination by a physician, Rubin and his co-workers said. It is their feeling that the most important gain from this technique is the increased response rate.

## Epidemiology . . .

### Nonmedical Interviewers In Morbidity Surveys

Techniques are needed by which morbidity surveys of the general population may be used by the epidemiologist to study associations in noncommunicable disease which are worthy of further investigation, stated Theodore Rubin, Ph.D., Joseph Rosenbaum, A.B., and Sidney Cobb, M.D., M.P.H.

Dr. Rubin is research associate in epidemiology and Dr. Cobb is associate professor of epidemiology, University of Pittsburgh Graduate School of Public Health, Pittsburgh, Pa. Mr. Rosenbaum was a research associate in epidemiology at the University but is now with the Rand Corporation in Santa Monica, Calif.

Clinical impressions are usually the basis for hypotheses about diseases, but clinical impressions are obtained from a biased population, and a way is needed to check these impressions in representative popu-

lation studies, Rubin and his co-workers said.

The use of the nonmedical interviewer as an alternative to mass screening techniques or clinical examinations is suggested as having the advantages of a high response rate, low cost, and an available staff to compensate somewhat for the lack of diagnostic accuracy.

The substitution of "virtual" classifications of disease obtained by nonmedical interviewers for the "true" classifications obtained by clinical examination by physicians presents certain limitations also. Rubin and his co-workers discussed these limitations and offered a formula for selecting a sample population and a set of questions that might be used, in lieu of clinical methods, to detect associations with rheumatoid arthritis.

#### *Further Study Warranted*

Despite the limitations imposed by the substitution of virtual for true classifications of disease, Rubin and

### Insured Groups Valuable In Genetic Studies

Enrollees of prepaid medical care plans provide an excellent medium for research into genetic and epidemiological problems of clinical medicine, according to Louis E. Schaefer, M.D., and David Adlersberg, M.D.

The contributions that such programs could make to genetic and epidemiological research "may eventually represent, quite apart from the socioeconomic value of prepaid comprehensive care on a group basis, significant and valid reasons for the existence of such planning," they said.

Dr. Schaefer is associate medical director, Central Manhattan Medical Group, and research assistant in medicine, Mt. Sinai Hospital, and Dr. Adlersberg is associate attending physician for metabolic diseases, Mt. Sinai Hospital, New York, N. Y.

Groups for the study of clinical genetics in man are much in demand, and population material must be readily available if genetic problems are to be worked out directly, they said. By using enrollees of prepaid medical care plans, entire families can be examined, pedigrees



can be established, and twins can be studied, they stated.

## Pedigree Method

Medical care plans, such as the Health Insurance Plan of Greater New York, enroll and provide medical care for families—parents and all children up to 18 years of age—as a unit, Schaefer and Adlersberg stated. In groups such as this, “an entire segment of a virtually unselected population can be investigated for the occurrence of an inherited trait,” and studies can be repeated in a relatively stable population, they pointed out.

Furthermore, laboratory and clinical studies can be made within the framework of the subscriber's ordinary relationship with his physicians, and complete records of the entire family are available in the offices of the medical group. An added advantage has been the cooperativeness of relatives of the families in the study group, who often must be questioned and examined to complete the research, they stated.

## Staten Island Studies

Schaefer and Adlersberg reported that studies of the genetic mechanisms in idiopathic cholesteremia are being made in families enrolled in the Staten Island medical group of HIP. Previous studies of this condition had been carried out in a hospital, but it was felt that investigations of a metabolic disorder of this type, which occurs in individuals who appear to be healthy otherwise, should be made in family groups representative of the general population.

Epidemiological studies of cholesterol levels have been conducted simultaneously with the genetic studies, they said. Findings indicate that the rapid increase in average cholesterol levels in men, beginning at age 20, produce changes which may result in the high frequency of coronary disease in the earlier decades of life; and that the same phenomenon begins 13 years later in women and continues 12 years longer than it does in men.

A longitudinal study of men and women whose cholesterol levels have been carefully observed through the critical decades will be required to prove this hypothesis, they stated, and the families in the HIP-insured group will be particularly suitable for such a study.

In conclusion, Schaefer and Adlersberg said that the Staten Island studies demonstrate the integration of genetic and epidemiological research with the clinical practice of medicine, using techniques employed by the internist in his daily practice, with no exploitation of or inconvenience to the patient, and that these studies will be continued and broadened.

## Study Accents Value Of Early Diagnosis

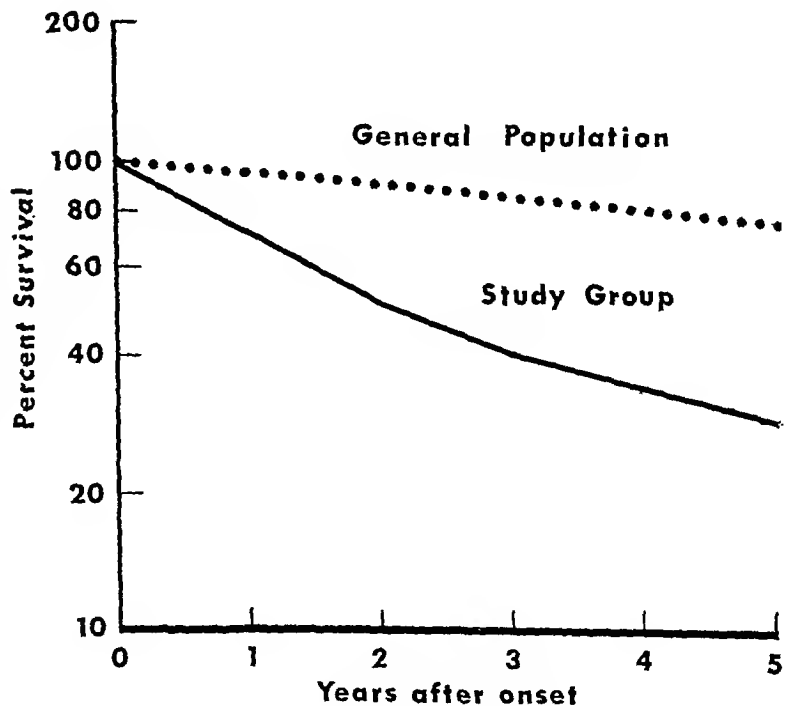
Recent New York State studies confirm that a great gain in survivorship of cancer patients will probably

result if cancer cases are diagnosed in the early, localized stage.

This opinion was expressed by Arthur S. Kraus, M.S., associate biostatistician, Morton L. Levin, M.D., assistant commissioner for medical services, Rita E. Cashman, M.S., biostatistician, and Paul R. Gerhardt, M.D., director of the bureau of cancer control, New York State Department of Health, Albany, N. Y. They reported results of a study of 2,065 cases of cancer with known or reported onset during 1940-42, found in 6 counties of northern New York State during the period 1940-47.

The 5-year survival rate for the cases in the study was 27.7 percent, Kraus and his associates reported. Survivorship was determined for single years up to 5 years after onset. Patients were classified as dead in 1 of the first 5 years following the onset of cancer, alive 5 years after onset, or lost to observation while alive in one of the first 5 years after onset. The probability of dying from cancer during a given year decreased

Survival rates of study group and general population.



in each successive year, from an annual rate of about 30 percent in the first year after onset to about 16 percent in the fifth year.

### *Site and Age*

Survival rates for cancer of the skin were higher than for cancer of any other site, Kraus and his co-workers said. The major sexual sites, followed by the major non-sexual sites, had the next highest rates of survival. Leukemia had the lowest survivorship rates of all major sites. The rate of survivorship for the six internal sites common to both sexes was higher for males than for females. The adjusted survival rates showed some difference in time trend for different sites.

The survivorship of all cancer cases of each sex was higher in the under-55 age group than in the older group, the investigators reported. This relationship was statistically significant for uterine cervix cancer in women under 35 and for ovarian cancer in women under 45, they said. While part of this relationship appeared to be explained by the tendency of younger cases to be diagnosed at an earlier stage of disease than older cases, factors other than stage

of disease at diagnosis appear to be involved. The study also showed that inclusion of a higher proportion of false positive cases among the younger group did not account for the higher survival rate of the younger group.

### *Stage at Diagnosis*

Persons of both sexes whose cancers were diagnosed in the early, localized stage had a higher survival rate than persons diagnosed in other and unstated stages. This finding was most striking for the sites with the lowest survival rates—ovary, bladder, large intestine, and rectum. The higher survivorship rate for patients with cancers diagnosed in the early, localized stage was not due to the inclusion of a higher proportion of false positives among this group.

Kraus and his co-workers concluded that the results of this study represent the minimum survivorship for the diagnosed cancer population of the six counties studied. They believe that, except for the factor of chance fluctuation, these results are approximately representative of the situation for the period studied in the entire State of New York, exclusive of New York City.

phases of the test. He designated the serum tested another variable.

The standardization of hemolysin and complement may be accomplished by checkerboard titration, and optimal dilutions obtained. Another procedure is the titration of hemolysin in the presence of a constant dilution of complement and subsequent titration of the complement in the presence of two units of hemolysin, he said.

"Several laboratories have streamlined the complement fixation test to accommodate the testing of large numbers of serums with several antigens by using a single dilution of complement for the entire battery of antigens. In this procedure, the amount of complement used for each antigen ranges from 1.5 to 2.0 units for each antigen instead of 2.0 exact units," he said, warning that such a system is hazardous unless controlled.

He recommended the restandardization of each lot of commercially procured antigen. Antigens may be titrated by the checkerboard or straight line pattern. In the latter case, serial dilutions of antigens are tested with a single dilution of homologous immune serum. If the titer of the reference serum is of too low a value, the antigen may not detect low levels of antibodies in a patient's serum.

The force maintained in centrifugation of the sheep red-blood cells may influence the sensitivity of the test. Bernstein advocated that directions for the application of centrifugal force in preparing cell suspensions be given in terms of gravitational units rather than the more commonly supplied revolutions per minute.

Also, he called attention to a process whereby centrifugation of cell suspensions for maximum cellular packing is unnecessary. With reference to the true hematocrit value for a portion of a washed-cell suspension, determined with a Bourke-Einstine hematocrit tube, and the volume of the stock suspension, a dilution may be prepared for the desired concentration. Suspensions

## The Virus Diseases . . .

### **Complement Fixation Tests Need Standard Procedure**

An evaluation of the various techniques used in the virus complement fixation test and the development of a standard procedure acceptable to all laboratories is needed, according to Alan Bernstein, Ph.D., acting in charge of the Reference Diagnostic Unit of the Communicable Disease Center, Public Health Service, Montgomery, Ala.

There are probably as many techniques as there are virus diagnostic laboratories, he said. This situation does not permit laboratories to handle maximum loads or compare results among themselves.

#### *Five Variables*

To illustrate his thesis, Bernstein referred to the standardizations of antigen, complement, and hemolysin and the preparation of constant concentrations of sheep red-blood cells suitable for this purpose as variable

prepared in this way may be more accurately reproduced than others.

Incubation of specimens for only 1 or 2 hours at 37° C. provides for a less sensitive but quicker and more specific test than overnight incubation in the cold. Although the former process may be resorted to in an emergency test, Bernstein advised that, for specimens thus found negative, the test be repeated with an overnight incubation period.

## *Special Problems*

The supply of positive serum for control purposes is more limited than that of any other necessary reagent, he said. Human serum is more desirable than animal immune serum, but even commercial stocks of animal serum are small. However, Bernstein held that through cooperation among virus diagnostic laboratories in different areas where different virus diseases are prevalent sufficient quantities of all types of human serum might be made available to all laboratories at little expense. For example, southern State laboratories could exchange typhus serum for lymphocytic choriomeningitis serums with the laboratories in the Middle Atlantic and New England States.

Concerning the interpretation of test results, he listed three possible complicating factors: haphazard collection of serum specimens; lack of ample clinical data on patients; and the occurrence of nonspecific reactions.

"Ideally, the first serum specimen should be obtained within the first few days after clinical onset and a convalescent specimen obtained 2 to 4 weeks later," he said. "The specimens should be submitted with a proper history that indicates date of onset and collection of specimens, a summary of the clinical symptoms, and the physician's provisional diagnosis. Information concerning vaccinations, recent travel, and intimate contact with animals or individuals with similar symptoms is as important as the clinical symptoms in aiding in the interpretations of results."

Problems of nonspecific reactions arise more frequently with antigens prepared from embryonated eggs than those prepared from mouse or guinea pig tissues. If necessary, he said, serums may be treated with normal embryonated egg membranes to remove a nonspecific antibody, or absorbed with packed sheep cell suspension if the antibody is of the heterophile type.

While the serums of some patients, especially those with positive syphilis serologies, are inherently anticomplementary, bacterial or chemical contamination of a serum may also cause anticomplementary reactions. Reactions of this nature may occasionally be attributed to excess amounts of oxalate, citrate, heparin, or merthiolate. Improper storage and handling of the antigens may result in anticomplementary reactions or deterioration of the activity.

"It is important, therefore," he insisted, "that every test include not only antigen and serum anticomplementary controls, but also a positive serum control, so that the potency of the antigen be known." Inclusion of normal antigen controls will indicate the presence of nonspecific reactions.

Bernstein mentioned several problems involving specific viruses or groups of agents. A history of recent vaccination, he said, may complicate diagnosis of influenza by complement fixation test and may be a problem in future serologic diagnoses of poliomyelitis. Again, the extensive use of broad spectrum antibiotics has resulted in a special problem in the diagnosis of infections by the rickettsiae and psittacosis-lymphogranuloma venereum group of viruses.

## **Lead Fight on Viruses, Health Officers Told**

With communicable diseases fading as the major public health concern, the health officer should lead in the fight against the "hard core" of

communicable viral infections, stated John E. Gordon, M.D., professor of preventive medicine and epidemiology, Harvard University School of Public Health.

In addition to applying the principles of communicable disease control and acquiring familiarity with characteristics of already known viruses, the health officer should contribute to new knowledge through field studies of virus diseases, he said.

Virus diseases include the most common, most dangerous, most curious, most obscure, and the main part of the newly discovered diseases, but, "to complicate matters, as virologists have expressed it, there are newly discovered viruses seeking a disease as well as the more orthodox situation of a disease looking for its viral agent," Gordon said.

As the practice of preventive medicine enlarges and as the composition of populations changes, neoplastic and degenerative diseases, mental disorders, and traumatic injury are properly incorporated into public health programs. Gains in the control of communicable diseases often permit more effort in these other fields. But, he said, judged by disabilities, deaths, and their contribution toward other conditions, the communicable diseases remain the backlog of the public health program.

## *Local Health Officers*

The local health officer has the main responsibility for communicable disease control. For virus diseases, as with all others, the measures put into practice depend upon information gained through practical field study of the particular situation, Gordon declared. Local health officers and physicians must know which viruses can be diagnosed in the laboratory and which cannot. They must also know the kind of material to collect for the laboratory and how to collect and forward such materials.

## *State Health Officers*

The State health officer should help by offering consultation and

by providing diagnostic laboratory facilities and skilled workers. As laboratories are costly and qualified workers are few, facilities are ordinarily provided by the State, or by arrangement with 1 of the 30 cooperating laboratories of the Public Health Service, he noted.

The State health officer should see that all physicians and local health officers have all the necessary information on virus diseases, Gordon declared. The preferred means for providing this information are short courses or conferences throughout the State, with distribution of an outline of the essential material. Alternatively, the outline and a letter may be used.

### *Practical Needs*

Reporting of epidemics as contrasted with routine individual case reports is especially important for viral infections of irregular occurrence and for ill-defined disease of possible viral origin. Such reporting, he said, should give the number of cases, within what time, approximate population involved, and apparent mode of spread.

Existing knowledge may well be applied toward a more reasonable practice of isolation in respect to a number of the more common virus diseases, he commented. The evaluation of control procedures requires more emphasis than commonly accorded that important feature. Ipsen's procedure for bacterial diseases, whereby serologic epidemiology was a measure of extent of use and past performance of an immunizing agent and in direction of future effort, has possibilities for viral immunizing agents, Gordon said.

### *Army Data on Viruses*

Data on the communicable diseases in World War II, just becoming available, show that 23.3 percent of reported cases of specific infectious and parasitic diseases were caused by viruses, Gordon said. If viral, presumably viral, and common respiratory diseases are placed in relation to all communicable disease,

the proportion of viral disease to the whole approximates two-thirds, he declared.

The military services have the most complete data on morbidity and permanent disability, he asserted. Communicable disease accounted for about half of all disease in Army troops during the war. Deaths from disease were only 5.1 percent of the total, 75.2 percent were battle casualties and 19.7 percent were nonbattle injuries. Disabilities, however, were 85 percent due to disease, the remaining 15 percent distributed between battle and nonbattle categories. Man-days lost were 285,918,000 from disease, 59,863,000 from injuries, and 72,000,000 from battle casualties, he reported.

The Army data are informative because they present evaluation of the communicable diseases in terms of death, defect, and disability. Judgment is too often on the sole criterion of death, Gordon asserted.

These Army data, representing American experience in most parts of the world, demonstrate that the communicable diseases are not outmoded, he said. Half of the world population lives in countries where communicable diseases rank first among causes of death. The infectious and parasitic diseases were  $2\frac{1}{2}$  times as frequent among American troops in the China-Burma-India theater as in troops in the United States. Control measures evaluated on experience in the United States are not always so effective in other parts of the world, even when applied to an American population by American physicians, he commented.

Specific control measures for smallpox, infectious hepatitis, poliomyelitis, and rabies were discussed by Gordon. Rubella and chickenpox were mentioned as virus diseases for which there is no practical control under present methods. The control of infectious mononucleosis, keratoconjunctivitis, and a number of other infections of presumed viral origin is within the province of research rather than practice, he said.

## **Find New Virus Group In Healthy Children**

The new types of enteric viruses discovered in 1953 in a study of healthy children in Cincinnati, Ohio, have since been found in even larger numbers in healthy Mexican children, according to a report by Manuel Ramos-Alvarez, M.D., and Albert B. Sabin, M.D., respectively, research associate and professor of research pediatrics, Children's Hospital Research Foundation, University of Cincinnati College of Medicine. The existence of these new viruses was revealed by the use of monkey kidney tissue cultures.

Among 1,491 children aged 1 to 4 years in Mexico City, nonpoliomyelitis viruses were found in 15.6 percent; among 280 children of the same ages in Veracruz, they were found in 10.0 percent, they specified. The comparative figure for the Cincinnati children was 5.2 percent. All the children studied were from low economic groups.

A total of 261 nonpoliomyelitis virus strains, they reported, were recovered from the Mexican children, about 65 percent of which still remain unclassified. Of 26 nonpoliomyelitis strains recovered from the Cincinnati children, 25 were found to belong to five distinct antigenic types which differ from previously known viruses, and 1 proved to be a Coxsackie B4 virus. Four of the five Cincinnati prototype viruses (2, 3, 4, and 5) were found in the Mexico City children, and one (type 5), in the Veracruz children.

### *Role in Disease*

The significance of these new viruses in the etiology of human disease is still a problem for research, the scientists pointed out. However, they declared, it is clear that they are not the viral counterpart of the normal bacterial flora of the human enteric tract because they are found more frequently during the early years of life and, at least in Cincinnati, are found only rarely in children over 10 years of age. (Of 837

Cincinnati children 10 to 17 years old, the viruses were found in only 0.2 percent.)

In preliminary serologic surveys among Cincinnatians, neutralizing antibodies for the Cincinnati viruses were found much more frequently among those aged 20 to 30 years than among those aged 1 to 5 years, Ramos-Alvarez and Sabin reported. However, only 3 percent of the older group had antibodies against all 5 types.

The following observations, they said, suggest that at least some of the new viruses may prove to be related to infections of both the respiratory and enteric tracts: A virus associated with an epidemic of rhinitis in chimpanzees and another associated with a family outbreak of an acute "steatorrheic" enteritis were found to be antigenically related to, though not identical with, the Cincinnati type 4 virus.

Another clue for further investigation is the finding by J. L. Melnick and his associates that some of the "orphan" viruses recovered from stools of patients with a diagnosis of either nonparalytic poliomyelitis or the aseptic meningitis syndrome were identical with the Cincinnati types 1 and 3 viruses.

### *Characteristics of the Viruses*

Ramos-Alvarez and Sabin gave the following additional information about the five Cincinnati prototype viruses:

Types 1, 2, 3, and 5 produce in cynomolgus monkey kidney tissue cultures cytopathogenic effects which are indistinguishable from those exhibited by the poliomyelitis viruses. Type 4 produces a cytopathogenic effect distinct from the effects produced by the others and from those produced by the poliomyelitis, herpes, and mumps viruses: A clumpy degeneration of the cells appears after an incubation period of 2 to 10 days. Only type 4 virus was capable of producing a cytopathogenic effect in cultures of kidneys derived from *Cebus capucinus* monkeys.

According to Dr. Irving Gordon and Dr. William Jordan, the five

Cincinnati viruses can be propagated in HeLa cells, although the yield of virus is low.

Dr. Robert Huebner has reported that these viruses do not belong to the APC group, and Dr. Robert N. Hull states that they are distinct from the cytopathogenic agents that he recovered from normal monkeys.

Human gamma globulin was found to contain antibody for all but type 2, and antibodies for type 2 have been demonstrated in individual human serums.

The Cincinnati viruses are not pathogenic for either suckling or adult mice by the intracerebral or spinal routes. They are not pathogenic for rabbits by the intracutaneous, intramuscular, or intravenous routes. Types 1, 2, and 3 are not pathogenic for cynomolgus monkeys by the spinal route, but antibody develops as a result of the inoculation.

## **Virus Induced Cancers Tied to Virus Theory**

No cancer has ever been induced in an animal or a medium known for certain to be free of viruses, asserted Francisco Duran-Reynals, M.D., in an exposition of the so-called virus theory of cancer. Dr. Duran-Reynals is lecturer and research associate, department of microbiology, Yale University School of Medicine.

Furthermore, he stated, a large number of cancers, especially in birds and mice, are induced by agents fulfilling all the requirements of viruses. Here the word "theory" with "virus" is unwarranted; it should be reserved for cancer in man and others of unknown etiology, he said.

The more we study viruses, the more we learn that they are present in tissues and culture media, often in an incomplete, noninfective state, he continued. He pointed out analogies between this situation and the "spontaneous" alterations or putrefaction of imperfectly sterilized media in Pasteur's time.

However, even if someday cancer is induced in animals in the proved absence of viruses, this will not change the fact that avian, murine, and other cancers are virus induced, he noted. It would mean that we have two types of cancer: infectious cancers and noninfectious cancers.

The virus theory, according to the speaker, holds that a cell invaded by certain viruses is induced to multiply at the same time that the viruses themselves multiply, an exogenous process. The only other view concerning the cause of cancer, the noninfectious view, contends that a sudden change leads to unrestricted cell multiplication even after withdrawal of the stimulus, an endogenous process.

The latter view is consistent with orthodox knowledge in histology, immunology, endocrinology, genetics, and other fields. However, since heredity, hormonal functions, and still other factors play a decisive part in making possible the effect of the virus, the knowledge accumulated in these fields is not only compatible with the virus theory also, but is indispensable for a full understanding of the virus realities, he stated.

### *The Age Factor*

In discussing the mechanism of induction of cancer by viruses, Duran-Reynals noted that the age factor is present in the following three events:

*Necrosis or stimulation of the infected cells.* Observations on viruses of either cancers or proliferative processes show that cell destruction occurs in the immature host, whereas tumor formation takes place in the mature host.

*Infection itself.* Avian tumors—the Rous sarcoma, for example—are able to infect other species—ducks, for example—only when the latter are inoculated during immaturity.

*Variability of the virus in the aging host.* In the Rous sarcoma chicken-duck sequence, infection of the immature host is followed by a long period of latency or incubation;

by providing diagnostic laboratory facilities and skilled workers. As laboratories are costly and qualified workers are few, facilities are ordinarily provided by the State, or by arrangement with 1 of the 30 cooperating laboratories of the Public Health Service, he noted.

The State health officer should see that all physicians and local health officers have all the necessary information on virus diseases, Gordon declared. The preferred means for providing this information are short courses or conferences throughout the State, with distribution of an outline of the essential material. Alternatively, the outline and a letter may be used.

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Q. Will the vaccine ever be 100-percent effective? A. We can have 100-percent effectiveness to the extent that lots of vaccine are consistent and resemble our "standard reference vaccine." We shall have vaccine approaching 100-percent effectiveness.

Questions which the panel did not have time to answer were referred by Dr. Merrill to Dr. Van Riper for collation. He promised to publish the answers to representative questions.

tacts of vaccinated individuals, and 20 among community contacts of vaccinated individuals.

In May 1955 safety standards and clearance procedures for poliomyelitis vaccine were revised. No epidemiological evidence has come to light that tends to render suspect any lot of vaccine of any manufacturer cleared under these revised safety standards, Langmuir stated.

Preliminary reports are now avail-

able from 11 States and 1 city on the effectiveness of poliomyelitis vaccine as used in the United States in 1955. These reports showed that rates for paralytic poliomyelitis were one-half to one-fifth as great among vaccinated children as rates among unvaccinated children of the same age.

In an attempt to find an independent confirmation of this trend in favor of the vaccine, data on the age distribution of all cases of poliomy-

Paralytic and nonparalytic poliomyelitis rates, 1952 and 1955.

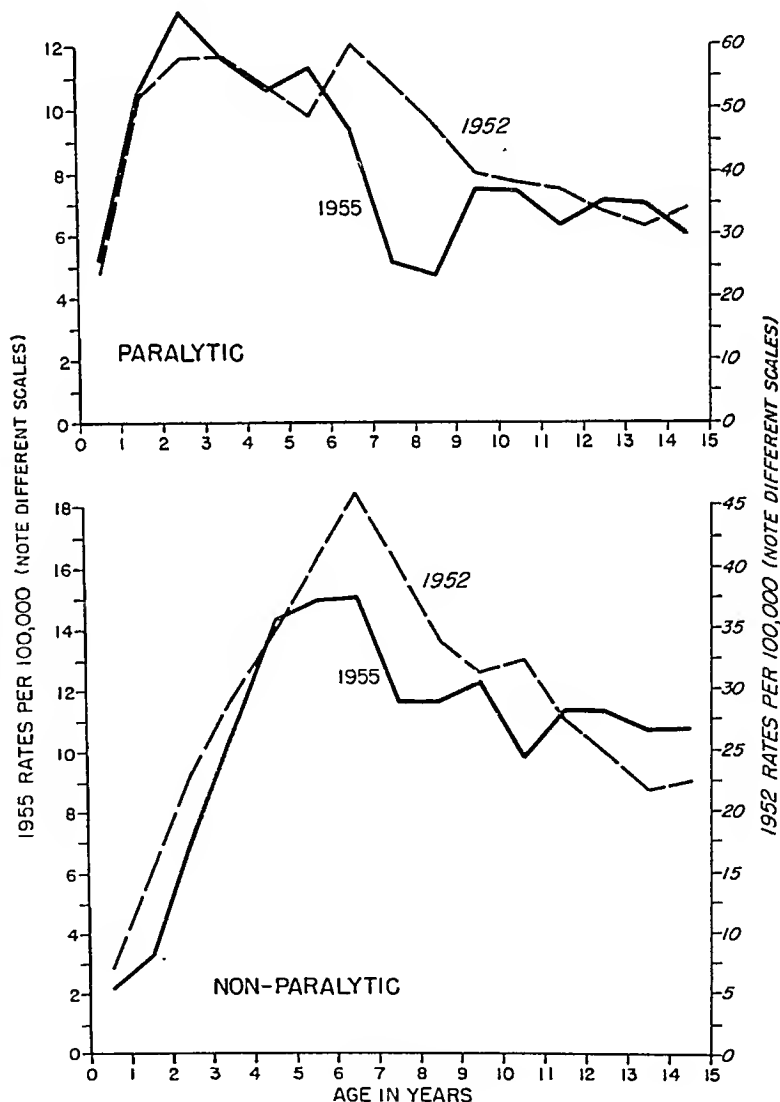
## Polio Surveillance Unit Finds Vaccine Effective

An epidemiological evaluation of the safety and effectiveness of poliomyelitis vaccine was described by Alexander D. Langmuir, M.D., chief, Epidemiology Branch, Communicable Disease Center, Public Health Service, in collaboration with Neal Nathanson, M.D., and Wm. Jackson Hall, Ph.D., chief and statistician, respectively, of the Poliomyelitis Surveillance Unit. This evaluation was based on the surveillance activities of the Communicable Disease Center.

The surveillance of poliomyelitis is one of the several parts of the Poliomyelitis Program of the Public Health Service. The others include the licensing of production and clearance of vaccines and the administration of grant-in-aid funds and of the voluntary Interstate program for vaccine distribution.

Since April 1955, the Poliomyelitis Surveillance Unit has acted as a clearinghouse for reports provided by the States and Territories, more than 40 participating laboratories, the National Foundation for Infantile Paralysis, and other sources of current data on poliomyelitis.

Langmuir also reported that the surveillance unit had received complete data on 204 cases occurring in association with vaccine produced by Cutter Laboratories. Of these 204 cases, 79 occurred among vaccinated individuals, 105 among family con-



then a tumor, always different from the original Rous sarcoma, develops. Usually, this cancer is no longer a chicken tumor but is a duck tumor, growing in older ducks as the origi-

nal Rous sarcoma grows in chickens; that is, the virus has changed and adapted to the new species.

Duran-Reynal presented examples and data to support his statements.

safety of vaccine have been strengthened by improving sampling procedures for tissue cultures and by increasing the sensitivity of the monkey tests. These measures, along with improvements in the processing, increase the assurances that vaccine which tests negative is, in fact, safe. With these elements of production under control, vaccine production is expected to proceed without delay, interruption, or frequent reprocessing.

Among questions put to the panel by the audience were the following:

*Q.* How long does protection last?

*A.* Dr. Salk said children who received the two-shot-plus-booster inoculation still had antibodies reflecting the booster effect after 30 months. Until the program is older, the duration of effect will not be known.

*Q.* Does the route of inoculation matter? *A.* Shots under the skin or in the muscles are both effective; the timing, the amount, and the antigenicity of the inoculations determine the effects, Dr. Salk said.

*Q.* Does vaccination prevent subsequent nonparalytic poliomyelitis?

*A.* The answer to this question is not definitely known. However, vaccination builds up enough resistance to infection to assure that an invasion will be unlikely to produce paralytic effects. There is also evidence that the vaccine may reduce the duration of infection and the amount of virus excreted.

*Q.* Will the Mahoney strain be superseded? *A.* No strain has been found that appears to confer superior protection against type 1 poliomyelitis. The interim report of the technical committee stated, "Vaccine properly made with the Mahoney strain provides an entirely safe immunizing agent."

*Q.* Did the vaccine contribute to the 1955 epidemic in Massachusetts?

*A.* Dr. Feemster said absolutely not. The Massachusetts epidemic followed the classic pattern of radiation from a focal point. It did not appear in many areas in which vaccine was used. It was not a multiple-focus epidemic.

## Poliomyelitis . . .

### Poliomyelitis Vaccine Production Advanced

A distinguished panel on poliomyelitis, in general session with the APHA, discussed the Salk vaccine with the assurance that the process of commercial production had been refined and that vaccine can now be produced without interruption.

Following an introductory statement by Jonas E. Salk, M.D., of the University of Pittsburgh School of Medicine, experience with the vaccine was discussed by other panel members: Robert D. Defries, M.D., University of Toronto; Lloyd Florio, M.D., University of Colorado; Thomas Francis, Jr., M.D., University of Michigan; Leonard A. Scheele, Surgeon General of the Public Health Service; and Hart E. Van Riper, M.D., National Foundation for Infantile Paralysis. Malcolm H. Merrill, M.D., director of public health for California, served as moderator.

The panel was assisted by David Bodian, M.D., Johns Hopkins University; Hugh L. Dwyer, M.D., Kansas City director of health; Roy F. Feemster M.D., director, division of communicable diseases, Massachusetts Department of Public Health; and Lawrence J. Peterson, Idaho director of health.

Dr. Salk's paper was supported by an Interim Report of the PHS Technical Committee on Poliomyelitis Vaccine. The committee includes Drs. Bodian, Francis, and Salk, Dr. Carl L. Larson, chief, PHS Division of Biologics Standards; Dr. Richard

E. Shope, Rockefeller Institute for Medical Research; and Dr. Joseph E. Smadel, Walter Reed Army Medical Center; with Dr. James A. Shannon, director of the PHS National Institutes of Health, as chairman. Both Dr. Salk and the committee reported studies which discovered unsuspected hiding places for live virus during commercial production.

#### Production Changes

In essence, the vaccine is produced by inoculating tissue culture media with a virus strain, filtering, and then treating it with formaldehyde to render the virus capable only of provoking the production of antibodies. In the final stages of production, three single strain vaccines are combined in a "polyvalent" pool.

During laboratory production and in the trial period, there was no evidence of infectious amounts of virus in the vaccine. Under conditions of large-scale production, however, sediments were observed in virus suspension which had been allowed to stand more than 3 days between filtration and treatment. It was reasoned that the precipitates which formed protected virus from subsequent exposure to formaldehyde, with the result that infective quantities of live virus were detected by tests of batches of vaccine. It is now the practice to filter vaccine within 72 hours of the start of inactivation and during the final stages of the formaldehyde treatment.

At the same time, tests for the



better than they used to be, but they are far short of the precision for which they are usually given credit. A certain amount of success has led to a routine acceptance and a lack of critical evaluation."

Although deaths from tuberculosis have decreased dramatically, the reports of new active cases and the number of current active cases are decreasing slowly, if at all. Tuberculosis will be a major health problem for generations unless new tools for control are developed, he asserted.

The basic difficulty in tuberculosis control is the reservoir of infection. Many of the estimated 40 million people who carry live tubercle bacilli will develop active disease, but their number and identity cannot be predicted each year on the basis of present knowledge, he said.

Discussing the deficiencies in laboratory tests, epidemiological data, drugs now in use, Feldmann went on to make the following points:

As a screening test, the survey chest X-ray is poor; at least one-third of the lung area is hidden from view. Also, the experts' subjective errors in reading may result in missing as much as 20 to 30 percent of the films showing significant lesions. The experiments with high voltage diagnostic X-rays, xeroradiography, or multiple views may lead to better results.

There is surprisingly little reliable data on how to use the tuberculin test or on which to determine its practicality. That no one technique or dosage is now considered superior is obvious from the variety of tuberculin tests in common use. Few attempts to relate test results to active cases found or missed have been made. A tuberculin test method suitable for rapid mass use would be welcomed.

In laboratory diagnosis, the current routine procedures for disinfection, as a preliminary to animal inoculation or culture, kill from 80 to 98 percent of the tubercle bacilli in the specimen. If tubercle bacilli are present in large numbers, the labo-

ratory test will be conclusive, but if few germs are present, they may not be detected.

## Treatment

Drugs in use are toxic, are not bactericidal, must be given over long periods, and often fail, Feldmann asserted. The exact mode of action is unknown and the clinical applications of the drugs have been built on a trial and error procedure, he declared.

Only pyrazinamide in combination with other drugs can be demonstrated to have an eradicated action in animals with tuberculosis. This supports the hope that a drug or a combination of drugs deadly to the tubercle bacilli could dramatically shorten the time necessary to eradicate the disease.

Research in nutrition may contribute much toward therapy and prevention of tuberculosis, he said. Although limited evidence indicates proteins and the vitamins A and C are of importance, little research is now going on to determine their specific roles.

Bacteriophages active against tubercle bacilli in humans have been conclusively demonstrated only recently. Advances in chemistry are making possible more exact determinations of the metabolism and the complex enzyme systems the bacillus maintains. The many strain variations have led to attempts at better classification and work on the relationships between drugs, virulence, and other attributes. All of this work, Feldmann declared, has focused interest on the possibility of new approaches to an effective vaccine.

## Urges Outpatient Therapy For Selected Cases Only

For tuberculosis patients who either cannot or will not be hospitalized, ambulatory treatment is indicated, advised Joseph B. Stocklen, M.D., on the basis of reported effectiveness of such treatment in a

fairly high percentage of patients. Dr. Stocklen is controller of tuberculosis for Cuyahoga County, Ohio, and assistant clinical professor of medicine and preventive medicine, Western Reserve University.

In view of an estimated 85,000 deficiency in tuberculosis beds, there is a choice of neglecting a large number of patients or treating them as outpatients, he declared. By providing outpatient treatment for this large reservoir of active cases, he emphasized, a substantial reduction should be made in the bacterial population and the incidence of tuberculosis should decline.

He based his estimate of bed deficiency on Public Health Service reports of the percentage of known active cases of tuberculosis that are hospitalized, the number of patients hospitalized, and the number of beds available.

Hospitalization, however, Stocklen said, is still the procedure of choice, despite success in outpatient treatment. He recommended that the patient be advised from the beginning that the hospital is the best place to treat tuberculosis both from his own standpoint and from that of the community. But if hospitalization is not possible, he stated, outpatient treatment should be planned for the patient.

## Effective and Feasible

Pointing out that the literature offers little direct evidence either to support or to condemn outpatient treatment, Stocklen cited three studies that "appear to indicate that outpatient treatment is effective and feasible in a fairly high percentage of selected cases."

In one study, reported in 1952 by Jane P. McCollough, 61 of 205 selected patients treated with pneumoperitoneum were considered to have inactive or arrested disease 1 year or more after treatment was begun. Except during an initial 3-day period, all treatment was given on an outpatient basis.

In a second study, reported by Arthur B. Robins and others in 1954, 348 unhospitalized patients with ac-

elitis in 1952 and 1955 have been collected from a total of 33 States. Analysis of these data has shown that paralytic attack rates were sharply reduced among children of ages 7 and 8 in comparison with rates for previous years. Langmuir stated that this sharp reduction, limited to the age group in which the great bulk of vaccine was used, constitutes an independent confirmation of the effectiveness of poliomyelitis vaccine as used this year for the prevention of paralytic poliomyelitis.

## Louisiana Study Probes Poliomyelitis Immunity

Observations on poliomyelitis infections, under way in a 5-year study of newborn infants and their family associates in about 150 representative households in southern Louisiana, are substantiating many of the inferences drawn from indirect and retrospective data.

Use of tissue culture techniques has enabled the four epidemiologists from Tulane University, who are conducting this first large-scale prospective study, to obtain first-hand information on when and under what circumstances people acquire immunizing infections against poliomyelitis.

Reporting the 109 episodes of infection observed since April 1953 were John P. Fox, M.D., Ph.D., M.P.H., Henry M. Gelfand, M.D., Dorothy R. LeBlanc, B.S., R.N., and Donald P. Conwell, M.D., M.P.H., all of the university's department of tropical medicine and public health.

To determine an infectious state, serum is examined for neutralizing antibodies and stools for virus. Specimens are collected monthly from the newborn index children and annually from the other family associates. Serum specimens and a basic epidemiological record were also obtained on admission to the study. Appearance of antibody or a virus isolation in the index child signals an immediate return to the household for further specimens and

clinical and epidemiological observations.

### Subclinical Infections

Among the more than 200 persons infected during the household episodes, Fox and associates reported, about one-third gave histories of minor febrile illness, but none had clinically diagnosed poliomyelitis, even though the infections were caused by viruses distributed as to antigenic type in about the same way as those concurrently causing paralytic disease in the study areas of urban New Orleans and Baton Rouge and the semirural Evangeline area.

The absence of paralytic disease is not surprising, they said, since it has long been recognized that paralysis occurs with only a small proportion of infections. The Louisiana findings go a bit further, they pointed out, by indicating that at least two-thirds of infections produce no obvious symptoms.

Intrahousehold spread to nonimmune members was the rule in these silent immunizing infections just as in families with cases of overt disease, they found. Ninety-five percent of the nonimmune members were infected along with the index child.

### Renewal of Immunity

They found also that 20 percent of the previously immune members were reinfected, but excreted little virus. Persons with relatively low titers, median 1:40, were usually

selected for reinfection. This "fairly unique" finding, they said, supports the theory that immunity may be renewed by occasional reinfection.

The virus types predominating differed in the areas and time periods. Type 3 virus was most prevalent in 1953-54 and type 1 in 1955. These data indicate that there are cycles of predominance of one or another virus type and that the cycles may be conditioned by corresponding deficiencies in immunity to the different types in the very young segments of the population, they concluded.

The findings on the relation of race, economic status, and family size to the early acquisition of infection and the season of occurrence were similar to those described by previous workers, they reported.

Infections, they found, were most common in Negro households, in families with older nonimmune children, and during the summer months.

Age specific frequencies of seroimmunity to the three virus types were determined for all members of the study households in 1953 and again in 1955. Overall, 60 percent were immune to a given virus by age 4 and 90 percent by age 10.

Immunity developed most rapidly in the Negro group. The white lower economic group followed fairly closely, and the white upper economic group lagged well behind. The immune percentages for the three groups in 1953 were 70, 74, and 64, respectively. These relative positions had changed very little by 1955, they said.

## Tuberculosis . . .

### Says Tuberculosis Research Needs Prompt Attention

Further advances in tuberculosis research are needed if the disease is to be eradicated or even controlled within a reasonable time, commented

Floyd M. Feldmann, M.D., Dr.P.H., medical director, National Tuberculosis Association, in discussing unresolved problems in tuberculosis research.

"To be brutally frank," he said, "the tools now in use are inadequate for the job. They are immeasurably

# RHEUMATIC FEVER

There, each tube was incubated for 6 hours at 37.5° C. in Pike's medium. Poured plates were prepared for each culture; at the same time, blood agar plates were streaked from each tube of Pike's medium. Plates were

read out after 24 hours of incubation at 37.5° C. Beta hemolytic streptococci were isolated from the blood agar plates. Lancefield grouping was carried out on these isolated organisms.

**Table 1. Group A beta hemolytic streptococcus incidence, by number of cultures**

Subjects	Number children	Number cultures			Percent cultures positive
		Total	Positive	Negative	
Rheumatic children, treated	53	1,000	6	994	0.6
Siblings, untreated control	104	705	45	660	6.4
Total	157	1,705	51	1,654	3.0

**Table 2. Group A beta hemolytic streptococcus incidence, by number of children cultured**

Subjects	Number children	Children with at least 1 positive culture	Children with all cultures negative	Percent of children from whom positive culture was obtained
Rheumatic children, treated	53	5	48	9.4
Siblings, untreated control	104	27	77	25.9
Total	157	32	125	20.3

health; Eleanor Thomas, A.B., principal serologist; and Anthony J. Lucci, B.S., senior serologist, New Jersey State Department of Health, Trenton.

New Jersey has been equipped for virus isolation work for a number of years, and psittacosis, had it been present to any extent in prior years, would have been diagnosed, they asserted.

## First Evidences

On September 20, 1954, the owners of a small turkey farm at Dutch Neck, N. J., noted that many of their 2,000 birds appeared to be ill and had developed diarrhea. Until November 22, various treatments were tried at the suggestion of a feed salesman, including sulfathiazole, penicillin, streptomycin, and aureomycin, mixing of the dosages in feed or water, and even intramuscular injections. Three hens and a tom died and were taken to Rutgers University for examination on November 1. Four persons who had helped inject the birds on November 2 became ill with virus pneumonia between November 9 and 28.

On November 22, 1954, the poultry diagnostic laboratory at Rutgers reported a positive diagnosis of psittacosis, and the farm was placed under quarantine by the State health department, they said. Birds were not to be sold without inspection. Blood samples were obtained from workers who had helped slaughter birds. Several additional birds were examined.

On November 29 enough oxytetracycline and tetracycline were obtained to treat all human contacts and to start an experiment to cure the birds. Birds that appeared ill or died prior to November 29 were sent to the University of Pennsylvania, where Dr. Raymond Fagan is cooperating in the experiment to evaluate treatment of the surviving turkeys, they said.

## Epidemiological Investigations

The farm owners raised no birds for replacement. Each spring, the stock was purchased from 5 sources,

which were diagnosed as psittacosis were attributed to contact with infected turkeys. Most of the cases were in persons who were employed as eviscerators. One laboratory technician was taken ill and believed to have died from psittacosis infection.

Reporting on the situation were Oscar Snssman, D.V.M., M.P.H., chief, bureau of veterinary public

# Studies in Zoonoses . . .

## Pneumonitis in Workers Linked to Turkeys

Psittacosis virus, which had been recognized in domestic turkey flocks in Texas, is believed to have been disseminated in 1954 in New Jersey by eggs or poults as latent carriers, or by infected shipping containers, three New Jersey scientists said.

At least 17 human cases of illness

tive tuberculosis were treated with isoniazid and PAS for at least 4 months. After 6 months, 39 percent had improved radiologically; no change was observed in 55 percent, and 6 percent showed progress of the disease. Of 222 patients with positive sputum, 99 converted to negative.

In a study of his own, Stocklen found that of 163 active tuberculosis patients treated as outpatients with streptomycin and PAS, 67 did not need hospitalization. These patients were observed for 9 months or longer.

All these studies, Stocklen remarked, were deficient in that the followup period was short and there was no control group. Nevertheless, he considered the evidence convincingly in favor of outpatient treatment in selected cases.

### *Against Outpatient Treatment*

Stocklen mentioned the following arguments against wide-scale use of outpatient treatment:

1. If the patient is infectious, he

very probably will be a greater health hazard at home than in the hospital.

2. Patients probably receive better care in a hospital than at home and thus the prognosis is probably better.

3. A policy of outpatient treatment may encourage some patients to leave the hospital against advice.

4. Some patients will develop antimicrobial resistant tubercle bacilli after prolonged antimicrobial therapy without conversion of sputum to negative. There is evidence that these organisms have the ability to infect other persons and that they retain their resistance.

In an outpatient treatment program, he said, sputum should be examined and chest X-rays taken at routine intervals. If at the end of 6 or 8 months of outpatient treatment, sputum has not converted to negative or pulmonary cavities have not closed, hospitalization should be insisted on. If the patient will not agree, enforced isolation should be considered.

None were positive. No antistreptolysin-O titers were above 500 units. In 7 families of these children, however, there was evidence of recent streptococcal exposure. Positive cultures were obtained from the nose and throat of one sibling in each of 4 families, and one sibling in each of 3 families had titers above 500.

Hamilton and his associates reported that in the period from January 1954 through October 1955, there were 2 peak seasons for streptococcal infections. Results of cultures for group A streptococci for the 21-month period are summarized in table 1. The protection against infection provided the treated children is indicated in table 2.

The frequency of positive cultures among the untreated was 10 times as high as among the treated children. This could happen by chance only once in 10,000 trials. The difference in the number of children with positive cultures (9 percent of those treated against 25 percent of those untreated) could have occurred by chance only once in 100 times. These data were analyzed statistically by chi-square.

In the study period there were no recurrences of rheumatic activity in the treated children. One untreated sibling under observation showed clinical signs of acute rheumatic fever, his first attack. His condition was recognized promptly. He was put under treatment; and he has been saved from residual cardiac damage.

Untreated children with rheumatic histories have about an even chance of a recurrence after a renewed streptococcal (Lancefield group A) infection. Prophylactic treatment aims to prevent progressive cardiac damage from such recurrences.

Cultures were taken at the Children's Convalescent Center, Kansas City, Mo., from the nose and throat on swabs. These were placed immediately in Pike's base as a transport medium and brought to the microbiology laboratories at the University of Kansas Medical Center.

## Rheumatic Fever . . .

### **Rheumatic Fever Study Uses Sibling Controls**

The effectiveness of injections of benzathine penicillin G in the prevention of rheumatic fever was described by Tom R. Hamilton, M.D., in connection with a 21-month study which included, as a control group, 104 siblings of 53 rheumatic outpatients, representing 50 families. While the outpatients were receiving prophylactic injections, their siblings had none.

Collaborating in the study were Antoni M. Diehl, M.D., assistant professor of pediatrics, and John S. May, assistant in microbiology and medical student at the Univer-

sity of Kansas School of Medicine, Kansas City, Kans. Dr. Hamilton is professor and chairman of medical microbiology at the medical school.

The authors in 1954 recommended siblings as a control in such a study on the grounds that members of one family in close contact live in a like setting and resemble each other genetically, with a similar susceptibility.

In the pilot study, benzathine penicillin G had been injected intramuscularly every 28 days in a dosage of 1.2 million units for each of 22 children. Cultures were taken for beta hemolytic streptococci of Lancefield group A from the treated children 28 days after the last injection.

larval or adult trichinae; or direct transmission when pigs eat infected carcasses. Both possibilities were studied by Zimmermann and associates.

The 9 tests in fecal transmission, using either infected rats or foxes as donor animals and either pigs, rats, or foxes as receptors, all proved negative. This should not rule out the possibility of fecal transmission, they stated, for other workers have carried out positive fecal transmission experiments.

It is difficult to ascertain what role, if any, rats and wildlife may play in the perpetuation of trichiniasis in grain-fed swine. Since trichiniasis is found in many of the species of wildlife, such species are an obstacle to the eventual elimination of this disease. This is true especially if a link is found between trichiniasis in swine and its reservoir in the wildlife. Then, the trichiniasis problem will only be more clearly defined, not eliminated, they said. It would be impossible, as well as impractical, to eradicate all species of wildlife which may act as reservoirs.

## Human Brucellosis Yields To Antibiotic Therapy

Streptomycin and sulfadiazine and other antibiotics have proved to be effective in the treatment of brucellosis—undulant fever—one of the more common diseases transmissible from animals to man, according to Wesley W. Spink, M.D., professor of medicine at the University of Minnesota Medical School, Minneapolis.

Spink pointed out that the causative bacteria are excreted in the milk of cows, sheep, and goats. Man contracts the disease by drinking unpasteurized milk obtained from infected animals. Another mode of transmission is by direct contact of humans with infected animals or their contaminated environment. Employees of meatpacking houses, livestock producers, farmers, veter-

inarians, and laboratory personnel are most likely to be exposed to the infection.

The disease causes acute symptoms resembling those of influenza, and a chronic and debilitating illness may result, Spink said. Since therapy is now available, prognosis depends largely upon prompt diagnosis and proper treatment, he said. A brucella agglutination test and blood cultures are the only sure determinants of the infection.

The first major breakthrough in treatment occurred in 1947, Spink reported, when a patient with subacute bacterial endocarditis provoked by *Brucella abortus*, hitherto fatal, responded favorably to a combination of streptomycin and sulfadiazine. The patient since has had no recurrence.

Effective results were obtained with aureomycin in 1948 at the Minnesota Medical School, when 90 percent of the patients treated recovered with treatment of this drug alone. Aureomycin has an advantage over other drugs in that it can be administered orally in capsules. An effective course is 2 capsules (0.5 gm.) four times daily for 21 days, Spink said.

More recently, tetracycline has been tried and found promising, Spink said. There is some evidence, he reported, that a combination of streptomycin and tetracycline may yield better therapeutic results in severe cases than the use of tetracycline or aureomycin alone.

Approximately 300 patients have been treated at the University of Minnesota Medical School from 1937 to 1955, he said. Because of the improvements in antibiotics, he declared that it now can be concluded that in a properly treated group the course of the disease is shortened, new complications do not occur, and complications that are present can be eradicated.

Eradication of the disease, Spink concluded, is dependent upon elimination of the reservoir of the infection in beef and dairy cattle, swine, goats, and sheep.

## Teamwork in Texas Ends Rabies Threat

When the number of animal rabies cases reported in Harris County, including Houston, Tex., reached a peak of 486 laboratory diagnosed cases in the latter part of 1953, it aroused citizens as well as officials to take emergency control measures. Their efforts, started in 1954, resulted in a rabies-free month in October 1955.

The events leading to what became the largest mass vaccination campaign against rabies ever conducted in the United States were described by Ernest S. Tierkel, V.M.D., M.P.H., chief, Rabies Control Activities, Communicable Disease Center, Public Health Service, Atlanta, Ga., Fred K. Laurentz, M.D., director, Houston Health Department, L. D. Farragut, M.D., M.P.H., director, Harris County Health Unit, and Reuben D. Wende, M.S., director, Houston Health Department Laboratory.

Although rabies incidence in the area had been carefully observed for 10 years, no organized control effort was made until after the high or record-breaking incidence was reached, they said.

The first control effort, a vaccination and leashing ordinance passed in 1945, applied only to the city of Houston. This was ineffective since animals exposed to rabies were often abandoned outside the city and became stray animals providing a reservoir of infection, they commented.

### Campaign Organization

The health department, in 1954, through the newspaper accounts and radio broadcasts, stimulated the public to act, they said. A Citizens' Rabies Advisory Committee was formed to inform the public, to coordinate control activities in city and county, and to gain community support for further control activities. Both health departments, medical and veterinary societies, farm groups, civic clubs, and the mass

3 in New Jersey and 2 in Pennsylvania, they reported. The Pennsylvania sources were referred to the State health department at Harrisburg.

At an Elizabeth slaughterhouse it was found that 2 of the 6 workers were ill. This plant had purchased birds from the stock farm.

One source at Englishtown, used by the Dutch Neck farm to replenish its stock, handled poultry. It also acted as agent for a New Brunswick hatchery which purchased eggs from the two Pennsylvania sources and from Texas and southwest California. At Englishtown 4 of the 5 workers were ill with severe colds during July and August, possibly from contact with infected poultry. The 19 bird serums tested indicated that there was probably little active infection at Englishtown. Two serums reacted at 1:8, three at 1:4.

A second source of supply, Turnersville, had no sick birds. The owner regularly included antibiotic in the feed, however. The owner had had bronchitis after Thanksgiving in 1953 and 1954; his serum titer was 1:4 as was that of one of the workers. Another worker had a 1:64 titer and reported a bad cold after Thanksgiving. This source purchased eggs for hatching from Texas and also bred some of its own stock.

The third New Jersey source was at Cranbury. The owner purchased poultry and eggs from Connecticut and Oregon sources, neither of which dealt with Texas firms. No illness was found in the birds.

### Laboratory Procedures

The indirect complement fixation technique was used to test the birds and the direct test was used in human serums. Lygranum antigen and high-titered human serums were used in place of positive pigeon serums. For humans, lygranum antigen or psittacosis antigen, supplied by the PHS Communicable Disease Center, was used.

Aliquot portions of human and of turkey serums were sent in some in-

stances to the CDC and the Hooper Foundation in California. Correlation of results from both laboratories were within limits of acceptable variations, they reported.

A 9-month serum sampling of the workers affected indicated significant reactions and corroborated prior diagnosis of psittacosis, they said.

## Iowans Find *T. spiralis* In Wildlife Species

Regulations in 47 States which prohibit the feeding of raw garbage to swine may be an important factor in the significant reduction in the incidence of *Trichinella spiralis* in pork products, according to W. J. Zimmermann, Ph.D., L. H. Schwarte, D.V.M., Ph.D., and H. E. Blester, V.M.D., of the Veterinary Medical Research Institute, Iowa State College, Ames, Iowa.

Zimmermann and his associates examined various pork products to determine the incidence of trichinae larvae. This study of 1953-54 as compared with the 1944-45 study in Iowa of trichinae larvae in bulk and link sausage showed 2.2 and 2.4 positive percentages as against 11.9 and 11.4 in the earlier study.

There were 187 cases of human trichiniasis reported in the United States through August 1955, of which 10 occurred in Iowa, they said. The incidence of human trichiniasis has fluctuated widely in the last decade; in 1945, 237 cases were reported in the United States with 133 of these cases occurring in Iowa. However, in 1950 there were 327 cases reported in the United States and none in Iowa, according to Zimmermann and his co-workers.

Although in the past the prime source of human infection was improperly cooked pork from swine which had been fed raw garbage, the source of infection for grain-fed swine remains an unsolved problem, they said. In the recent study, diaphragms of 2,184 swine were exam-

ined. The swine were chosen from four areas of Iowa, from college herds, and from a small packing house. Only one proved positive.

### Wildlife Reservoir

To determine if wild animals were the reservoir perpetuating the trichinae, 119 rats were obtained. These included 10 from the Veterinary Medical Research Institute, 17 from a farm, and groups of 61, 20, and 11 from three separate villages and city dumps. Fourteen of the 61 rats from one of the dumps proved positive. This was the same area from which 1 of 687 pig diaphragms proved positive. All other rats in the study were negative.

Eighty-five wild mink were examined during the two seasons of the study. Twelve (14.1 percent) were positive. The finding of trichiniasis in the wild mink is of particular importance since the disease had never been reported from this species in the United States. All ranch-raised mink examined (four) were negative.

Thirty (11.9 percent) of the 252 adult foxes examined during the 2 years were positive. The intensity of the infections was less than in some other species. Only 1 fox cub out of 56 proved positive.

Of 40 opossums only 1 was infected with trichinae. This infection was not intense and is possibly the first reported in this species, they said. Of 229 raccoons examined, only 2 were positive, while there were 2 coyotes out of 4 examined that were infected.

A variety of other animals were examined with negative results. The Iowa study group believes that a possible explanation for the absence of infection in carnivorous birds and snakes is that the body temperatures of these animals do not favor survival of the parasites.

### Modes of Transmission

Two possible modes of transmission of trichiniasis from wildlife to swine have been suggested. They are fecal transmission, either of

previous campaign, and how many persons live in the unit.

## Unowned Dogs

Stray dogs were assumed to be distributed in the same manner as the dwelling units where food would be most likely available, and a drag-net procedure at sampling points is to be arranged, they said. The drag-net, according to the local humane officers, would be best in the early morning hours when it is cool and the dogs are out looking for food. Thus, they explained, the same sampling method could be used on owned and unowned dogs. When this sample is made in the spring of 1956, the figure will be added to the maximum estimate (212,000) of owned dogs to give health officials the data they need as to actual dog population in the inoculation program.

## State Laboratory Confirms Leptospirosis in N. C.

On the basis of recent laboratory tests, leptospirosis appears to be widespread in North Carolina. As a result, serologic tests for leptospirosis now are a routine procedure in the North Carolina State Laboratory of Hygiene.

Nell Hirschberg, Ph.D., bacteriologist, and Lynn Maddry, Ph.D., assistant director of the laboratory, and Martin Hines, D.V.M., chief of the section of public health veterinary medicine, North Carolina State Board of Health, stated that the suspected prevalence of leptospirosis makes laboratory diagnostic services essential at the State level. They advised health officers of other States that cases reported as infectious hepatitis may actually be leptospirosis. Furthermore, whenever leptospirosis is diagnosed among domestic animals, health officers should be alert to the possibility of the disease in humans.

North Carolina is not experiencing the classic Weil's disease, they said, but rather a mild form, usually, but not always, accompanied by jaundice.

Domestic animals, especially dogs carrying *Leptospira canicola*, and cattle carrying *Leptospira pomona*, transmit the infections to man.

Weil's disease is rarely reported in the United States. It usually occurs among persons such as trench diggers and subway workers who work in the ground or who come in contact with rats.

Since the North Carolina laboratory announced the diagnostic service, it has received an increasing number of requests for *Leptospira* tests on patients who have had no contact with rats and who appear to be ill with symptoms resembling those of infectious hepatitis or influenza.

Veterinarians in the State are also receiving an increasing number of requests for *Leptospira* tests on animals, they stated, but apparently there is no correlation between the two types of requests.

## Infectious Hepatitis

Hirschberg, Maddry, and Hines reported that until recently only 1 or 2 cases of leptospirosis in humans have been reported annually in the State.

Although only 10 cases of leptospirosis and a similarly small group of serum jaundice cases were reported in 1954, the laboratory results suggest that most of the specific but unreported cases of leptospirosis probably had been reported as infectious hepatitis.

They believe that a large number of cases in the past were reported as "infectious jaundice," a classification which included bacterial and viral hepatitis until the title was changed to infectious hepatitis in 1952. All forms of infectious hepatitis except leptospirosis are now grouped under the single classification on the revised report form.

A 1954 survey showed infectious hepatitis spread over the entire State with large numbers of cases from counties with diagnostic medical centers or occasionally from counties in which there was a well-defined epidemic. All told, there were 1,055 cases of infectious hepatitis reported,

and probably many of these cases were in fact leptospirosis, they stated.

## The Test

The choice of serologic tests depends to some extent on conditions in the laboratory performing the tests, Hirschberg and her associates stated.

The agglutination test with formalin-killed *Leptospira* became standard in the North Carolina laboratory in January 1954. The agglutination-lysis test is not used routinely because of the danger inherent in the use of the living, motile organism. When paired serums are available, the North Carolina laboratory sends them to the Communicable Disease Center Laboratory of the Public Health Service for complement fixation.

One of the paradoxes of the disease is the ability of the *Leptospira* organism to remain alive for years in natural waters, to grow in tap water fortified with serum, and yet to disintegrate spontaneously without warning in the laboratory or remain alive without apparent multiplication.

No examples of positive tests have ever been found in individuals who have not been infected with the organism before or who are not ill with leptospirosis at the time. In other words, native antibodies to these organisms are not found. Sixty-three veterinarians who were bled for *Leptospira* all tested negative.

Four standard strains of *Leptospira* are considered sufficient to prepare antigens for routine agglutinations: *Lept. canicola* and *Lept. pomona* as well as the agent for Weil's disease, *Leptospira icterohemorrhagiae*, and the cause of Fort Bragg fever, *Leptospira autumnalis*. Eight other strains were tested to see if infectious with exotic strains might also be prevalent in North Carolina.

The organisms are grown in a modified Korthoff's medium for 5 days, killed with 0.3 percent formalin, allowed to stand for 24 hours, then

publicity media constituted the nucleus of the organization, they explained.

A review of human rabies cases in Houston and in Harris County in a national journal gave the campaign impetus. Additional pickup trucks and crews were obtained and a modern animal shelter was built in Houston.

The major wedge into the rabies front came, however, when the Texas State Legislature, meeting in special session, authorized metropolitan counties to require vaccination of all dogs, they declared.

The help of the Public Health Service was obtained at the request of the county health officer through the State health department. An intensified emergency rabies control campaign was charted with the Houston Veterinary Medical Society and the Houston and Harris County Health Departments. The plans called for free prophylactic antirabies canine immunization with services donated by the local practicing veterinarians and vaccine and clinic supplies provided by the local governments.

### *Immunizations*

Ninety-two locations were chosen as clinic sites. These were selected on a basis of population densities and rabies incidence. Fire department stations offering large, sheltered work areas with available parking space nearby, were used.

A 4-day schedule was set up, with arrangements made for early evening as well as afternoon sessions. The city and county were divided into four sections. An average of 23 clinic sites were set up in each section.

Because of the publicity, efforts of the citizens' committee, the campaign itself was largely a matter of letting the public know the clinic sites, dates, and time. Newspapers, radio, and television cooperated. Literature and posters were distributed through the city and county school systems, with clinic schedules attached. Although dog registra-

tion or licensing was mandatory in the city and county, the requirement was not mentioned in the vaccination campaign.

Operation of the clinics was kept as simple as possible. With vaccination, a tag and certificate were issued. City and county sanitarians supervised each clinic; one or more veterinarians administered the vaccine; public health and Red Cross volunteer nurses helped prepare the syringes; and clerical duties were performed by Boy Scouts, 4-H Clubs, and other volunteers.

Each clinic began operating with supplies for 300 dogs, but after 1½ hours on the first day practically all clinics had exhausted the supply. Police and sheriff's radio cars were used to deliver supplies. For the following days, supplies were doubled, but still, in some instances, additional supplies were needed, they said.

With the 4-day campaign and a clinic at the dog shelter on a fifth day, 44,390 dogs had been vaccinated, the largest number ever immunized in the United States in one campaign, according to Tierkel and his associates, and with the 20,000 privately vaccinated dogs they gave the county a large population of rabies immune animals.

Decline in rabies incidence was slow from September 1954 through May 1955, they said, but became more rapid through June–September, and no cases were found in October 1955.

### **Estimates Dog Population By Sampling Procedure**

A statistical method for accurately estimating a community's dog population was developed early in 1955 in Harris County, Tex., as part of a rabies control program that originally had been based on a rule of thumb estimate of 1 dog per 10 humans.

Reporting the new method were: Joseph L. Zarefsky, M.S.W., director, research bureau, Houston Community Council; Dale Houghland,

M.P.H., health education director, and Reuben D. Wende, M.S., laboratory director, Houston Health Department. The rule of thumb estimate of the dog population was 100,000, they said. The sampling method gave an estimate of 191,000 owned dogs.

The new procedure stemmed from a request by the Houston Health Department and the Harris County Health Unit after the laboratory reported there had been no sharp decline in the number of rabid dogs found 6 months after a community-wide rabies inoculation campaign, they said. The possibility that the inoculations had not reached as high a percentage of the dog population as thought prompted the request.

### *Owned Dogs*

The procedure had to be developed quickly, without extra funds, they said. Harris County has 1,700 square miles and a population of 1,023,000. Houston has one-tenth of the land and 70 percent of the population.

Essentially, the method is to use a simple probability sample to ascertain the average number of dogs per dwelling unit with a maximum error of 10 percent at the 95 percent probability level, they explained. To find the size of sample required, it was assumed that there was 0.24 dog per dwelling unit as had been found in the 1952 Denver study.

It was found that a sample of about 1,700 dwelling units throughout Houston and Harris County would yield an estimate of the required precision, they reported. On the basis of census tracts in the county, sampling points were allocated in the same proportion as the dwelling units—a tract having 2 percent of the county's dwelling units received proportionate attention, they explained.

The enumeration was completed in about 3 days. The schedule had four questions. The first was on dog ownership and if the answer was "yes," how many dogs were owned, was each dog vaccinated during the



hasten dessication or by turning top soil to put the eggs out of reach of children.

Keep dogs and cats free of worms that endanger the health of children.

Families with small children perhaps should forego having cats and dogs and pets even though this measure is not fully protective in an urban neighborhood.

the University of Michigan School of Public Health.

Like an exotic plague, he said, the communicability of housing decay affects a susceptible population, which, although it eats well, dresses well, and plays well, includes too many who do not live well. The contagion of housing endodecay, which encourages room overcrowding and insanitary practices, and the contagion of housing exodecay, which creates shabby properties with decreasing values, have spread from block to block, from area to area, in all of our major cities.

To combat the plague of housing decay in urban America, a voluntary nationwide civic planning agency was organized to replace public apathy and neglect with ACTION. A.C.T.I.O.N. is the American Council To Improve Our Neighborhoods, and its 60-man governing board represents public health, industry, government, education, finance, civic and trade organizations, labor, and public service.

Vaughan, as one of ACTION's directors, described the work of the nonprofit, nonpolitical organization, which is financed by gifts from many sources.

The Ford Foundation has granted \$250,000 to study impediments—and the means to remove them—to the provision of adequate housing. The Advertising Council has provided public service time and advertising space for ACTION's national education program, which is designed to alert citizens to housing opportunities and problems.

ACTION has opened the first of many local information centers in Cleveland to provide information on housing research techniques, code enforcement, legislation, community organization, and planning.

## Enterococcus Indicators Aid in Water Tests

An enterococcus test would be a useful addition to the coliform test in gauging the bacterial contamination

# Environmental Health . . .

## Urges Work Begin Now On Cities of Future

To match the technological marvels forecast for the city of the future with improvements that will assure a healthful, comfortable environment is the challenge facing the public health engineering profession, said Morris M. Cohn, Sc.D., editor of *Wastes Engineering*, New York.

With a 60 million increase in population expected by 1975, both central cities and fringe areas will experience growth, Cohn predicted. The challenge, then, is to rehabilitate central cities to meet the standards of 1975 and to build fringe communities in a pattern that will be modern two decades hence. It is necessary to plan entire areas on a metropolitain basis, so that the pieces of community life can be integrated into a well-organized tapestry, he said.

"We need a multibillion dollar sewage treatment construction program," he contended, "to provide new facilities and regear old works. . . . We must put billions into industrial waste pollution control programs. Waterworks systems must be expanded and improved to provide water of unimpeachable palatability, serviceability, and safety to meet the needs of 225 million people. Drought control and flood control must be achieved, not only by engineering structures, but by learning how to anticipate the vagaries of nature. . . .

"The refuse dump must be outlawed as an incongruity in modern community life. If our standards

will not eliminate these areas, the filling in of blank land by people, instead of municipal rubbish, will surely outmode them. The fly, the rodent, the mosquito . . . must be eliminated by environmental sanitation practices. Slums must be wiped out, as breeders of unhealthy minds, bodies, and spirits. Food and milk sanitation must achieve superior standards of cleanliness and purity, perhaps through the use of such devices as atomic radiation. Smoke, smog, smaze, and smist must be cleared from the atmosphere by new methods of atomic heat and power and control of stack gases. Cities must be freed from litter."

In the light of the dreams and fantasies that have come true in the past, these goals are not impossible, Cohn declared. "If we blend our dreams with the vital ingredient of courage, we will assure a better nation and a better life in 1975," he said.

## National Group To Attack Neighborhood Decay

Nearly half of America's 45 million nonfarm dwellings need routine maintenance to remain in acceptable physical condition. Another 20 million require repairs and improvements or substantial rebuilding to prevent eventual slums. An estimated 5 million slum dwellings must be eliminated and replaced by new homes. This is the target for a public health program envisaged by Henry F. Vaughan, Dr.P.H., dean of

centrifuged and used after 48 hours. The antigens remain satisfactory for 10 to 30 days. The test is not a suitable one for small laboratories, they said.

## Results

Apparently there was no correlation between the infections hepatitis reported and the specimens tested with regard to location, age, sex, or color. Of 441 specimens tested, 109 were positive. Twenty-nine agglutinated *Lept. canicola* and 36 *Lept. pomona*. The remainder showed cross agglutination.

Most of the specimens came from school children and also from adults in the age group between 30 and 34 years. Hide workers accounted for 21 of the positives, but 61 were unaccounted for. The rest were from housewives, caretakers, nurses, physicians, farmers, food-handlers, morticians, and factory workers.

The North Carolina laboratory does not routinely test animal specimens, but serums were received from animals associated with human leptospirosis. However, the new animal diagnostic laboratory in the State occasionally referred icteric serums from animals in which the diagnosis was obscure.

Of the 93 animals tested, 69 tested positive with some degree of cross agglutination but less than was experienced with the human specimens. Fifteen of 18 dogs were positive, 10 with *Lept. canicola*. Thirty-seven of 49 cattle were positive, 31 with *Lept. pomona*. Positive specimens were also distributed in low numbers among swine, horses, goats, mules, and sheep.

## Visceral Larva Migrants— A Public Health Problem?

Recent studies show the dog to be an important reservoir of visceral larva migrants, a newly recognized disease responsible for long periods of subnormal health in young children, according to Paul C. Beaver,

Ph.D., professor of parasitology, Tulane University School of Medicine.

Visceral larva migrants was so named because the causative agent, a nematode larva, *Toxocara*, migrates extensively in the internal organs much the same as the hookworm larva that produces cutaneous larva migrants migrates in the skin, Beaver said. One feature of the infection is that the larva of *Toxocara*, a common worm parasite of dogs and cats, can invade nearly all tissues of children. The larva undergoes several weeks of active migration and can persist alive for months. Dogs and cats are natural hosts for *Toxocara*; man is not.

Beaver reported that a high percentage of dogs the world over have been host to *Toxocara canis*, that *Toxocara* eggs are eliminated in the feces, and that surface soil samples from urban dooryards show hundreds of viable eggs in a few grains of soil. The eggs will remain infective in damp soil for months if permitted to accumulate. Many *Toxocara* eggs destined by nature to find their way into dogs and cats are swallowed by toddlers known as dirt-eaters, he said.

"In well-organized communities popular sentiment in favor of further limitation of the freedom of dogs, even those walked on a leash, probably is ready for public expression," he said. "It is not now a question of whether promiscuous defecation by dogs is a public health hazard. The real question is whether a way can be found to discuss this public health problem openly and to reach agreement on acceptable control measures."

## Newly Described

Beaver said that the incidence of visceral larva migrants is unknown. In the absence of satisfactory methods of serologic diagnosis, proof of infection is based on biopsy or autopsy findings. Further, the disease, though doubtless ancient, was first recognized in 1952 in New Orleans. Reports show that the dis-

ease is gaining recognition outside Louisiana, and *Toxocara* larvae may have caused at least one human death, he added.

Symptoms of *Toxocara* infection vary with the number of larvae involved and the duration of the infection. Light infections usually are well tolerated, and the majority of infections probably are subclinical. Clinically, the disease may resemble pneumonia, miliary tuberculosis, asthma, whooping cough, eosinophilia leukemia, and retinoblastoma.

A sharp increase in the number of circulating eosinophils is conspicuous in all *Toxocara* infections. Even in the absence of apparent symptoms, the number of eosinophils may exceed 50 percent of the total leukocytes. Formerly, the disease was often referred to as Loeffler's syndrome, familial eosinophilia, tropical eosinophilia, leukomoides disease, and eosinophilic pseudoleukemia.

The child with moderate infection usually has fever, an enlarged liver, and some degree of pulmonary infiltration in addition to the marked increase in eosinophils, he continued. With heavier infections, these symptoms become more marked, and a history of dirt-eating is usual. There may be cough, muscle and joint pains, and abdominal pains. Occasionally there are impetiginous lesions on the buttocks and legs. Less often there are convulsions and petti mal attacks and infections involving the eye.

## Individual Control

Since no specific treatment for visceral larva migrants and no effective method for killing *Toxocara* eggs in the soil are known at present, prevention becomes of chief importance, Beaver emphasized. He listed the following means of prevention to help parents protect their young children from possible infection in the absence of rigid dog control:

Prevent children from eating dirt.  
Destroy *Toxocara* (to some extent) by working surface soil to

culties formerly encountered in weighing and analysis, he said.

The sampler mounts an 8" x 10" rectangular filter sheet in a stainless steel holder giving an effective filter area 7" x 9", or 63 sq. in. Air is drawn through the sampler by a vacuum cleaner type motor, initially at 50-60 c.f.m., with a drop in flow rate as sampling proceeds. The filter is reported to be 99.9 percent efficient for particles as small as 0.1 micron in diameter, he remarked.

Describing other air sampling methods, Tabor mentioned dustfall sampling through sedimentation as the oldest and most widely used method. Particulate matter falls by gravity or is carried by rain into a jar with a mouth of known size. A trapping liquid, usually water, prevents the dust from blowing out again. The weight of solid material collected during a month is reported as tons per square mile. The material collected is easily analyzed. The British have adopted a standard dustfall apparatus, and attempts to standardize are now going on in the United States.

Other samplers using the sedimentation principle are a directional dustfall collector and a settlement dust counter, he said.

Impaction sampling uses deflection of an air stream to collect particles for counting and sizing. By their momentum during a sudden change in airflow direction, the particles are deposited on a prepared surface. Available devices using this principle are the Owens jet dust sampler and the cascade impactor, he reported.

Thermal precipitation depends on the phenomenon of the dust-free space adjacent to a hot body. If dust-bearing air is drawn through a narrow channel past the hot body, the particles are deposited on nearby cold surfaces. Devices using this principle have a sampling head with heating and cooling devices and an air pump. There are several thermal precipitators available, and the devices are very efficient for collecting particles smaller than 5 microns, he declared.

Electrostatic precipitation samplers operate on the principle of the attraction of charged particles to an electrode of opposite charge. These devices are nearly 100 percent efficient for collecting particles below 5-10 microns. There are a variety of these samplers available. Collection of samples free of any medium is a major advantage of these devices, Tabor said.

## Reviews Cook County's Disposal Difficulties

A "blow by blow" account of the mismanagement of sewage disposal installations in the expanding municipalities and subdivisions of suburban Cook County, Ill., was presented by Benn J. Leland, M.S., chief sanitary engineer of the county's department of public health.

Cook County, the largest county in Illinois, includes, besides Chicago, an area of 750 square miles and a population of about 800,000. Chicago's suburbanites dwell in 100 incorporated municipalities and in a great number of subdivisions. Such subdivisions have their own water supplies, wells in the front yards and seepage fields in the backyards. The seepage of septic tanks has produced a harvest of nuisances and health hazards in much of suburban Cook County.

However, the problems are not confined to subdivisions. A number of municipalities are not served by domestic sewer systems. Most of these communities have exercised less control over sewage disposal than the unincorporated areas.

Impervious clay soils are prevalent in the county. Most complications have arisen because individual seepage fields could not absorb septic tank effluents, which were therefore discharged in surface pools, roadside ditches, or creeks, creating odor nuisances and health hazards. Reports from 25 sanitary engineers serving other county health departments revealed that similar situations exist elsewhere in the United States, Leland said.

## Construction

Residential construction increased sharply in the years after 1950, and building sites in areas served by sewers and public water supplies became ever more scarce. Most developers felt they could not finance installations of public facilities to new areas. They have perforce built residences with individual septic tank systems for sewage disposal.

In addition, since Cook County zoning ordinances permit lots of 10,000 sq. ft. in certain areas, many developers endeavor to have their lots reclassified from farming, 5-acre, 1-acre, or ½-acre zoning to the 10,000-sq.-ft. category, which provides the maximum number of building sites on a tract.

"While a lot of 10,000 sq. ft. is a good sized lot if public water supply and sewerage facilities are available, in many instances it is not possible to install adequate private facilities on such a limited lot area," said Leland.

All this has resulted in an avalanche of complaints to the public health department, which makes inspections and advises home owners of necessary improvements. If voluntary compliance is not secured, the department initiates enforcement action, but, ironically, such action must often be taken against property owners who perhaps have not even been aware of having been served by a septic tank and seepage system until it has failed.

## Percolation Tests

In 1954, an ordinance was passed requiring that plats of proposed subdivisions, to be accepted and approved, must contain certifications that water supply and sewage disposal facilities conform to standards of design and safety adopted by the county's department of public health.

A report on soil percolation tests by a "qualified registered professional engineer" was required to accompany plats if individual sewage disposal systems were to be used. However, the ordinance did not call for the review of such reports by the public health department, although an interdepartmental arrangement

tion of well water, particularly when the coliform values are low or fluctuating.

This conclusion was drawn from a comparison of the two tests on water samples from 595 wells in 12 Kansas counties. To check the results of single samples from each well, an additional 86 samples from 59 wells were examined at intervals of 2 weeks to a year after the first sample. Detailed information on the physical aspects of each well was supplied through a questionnaire.

The study was conducted by Cassandra Ritter, M.A., chief bacteriologist, Ivan F. Shull, B.S.C.E., M.P.H., chief of the general sanitation section, and Robert L. Quinley, A.B., assistant bacteriologist, division of sanitation of the Kansas State Board of Health, University of Kansas.

The coliform MPN index was determined according to standard methods. For the enterococcus MPN determinations, the azide dextrose broth of Rothe, favorable to the growth of all enterococcus groups, was the presumptive medium and crystal violet azide broth the confirmatory medium. Another method in use, they explained, is selective for *Streptococcus fecalis*.

The coliforms and enterococci found in the well water samples were comparable in number, they reported (see diagram). Statistical evaluation showed the association of these two groups of bacteria was not by chance.

Results from 269 samples were negative in both tests, they found. At the other extreme coliforms in excess of 1,100 were always accompanied by enterococci. The 83 samples with enterococci alone and 49 samples with coliforms alone, plus the changes in numbers and relationships found in the check samples, suggest that the enterococcus test may be most useful when coliform values are low or indeterminate, they said.

#### Favor Inclusive Medium

Of the 424 enterococcus strains isolated from 80 samples selected at random, 284 were typical of *Streptococcus fecalis* and 140 fell into the atypical group. Of the 28 samples with atypical strains only, 78.6 percent yielded no coliforms. A high percentage, 84.6, of the 52 samples with typical enterococci was associated with coliforms in appreciable numbers.

It is possible, they said, that samples showing only atypical enterococcus recoveries may have contained typical strains at the source. However, their observations suggested that typical enterococci will be recovered if present since their growth is faster than that of the atypical strains.

Ritter and associates concluded that an inclusive medium is the method of choice for determining enterococci in water and compares with the standard method for determination of the coliform group.

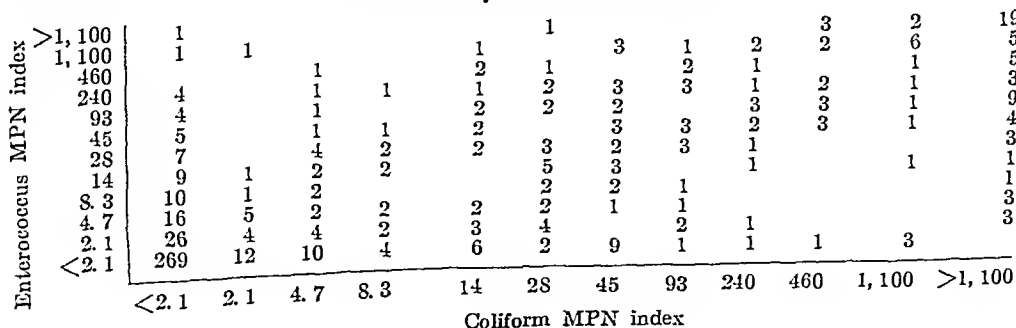
Their evaluation of the physical aspects of the wells according to the coliform MPN index indicated that construction of the supply is more important than location. A greater degree of sanitary safety was suggested for the 453 drilled and driven wells. A coliform index of less than 2.1 for 70 percent of this group was reported; 13 percent had an index value greater than 28. Of the 121 dug wells, 18 percent had an index lower than 2.1 and 58 percent an index higher than 28.

#### Reviews Various Devices For Sampling Air

A review of several available sampling devices for the collection of suspended particulate pollutants from the atmosphere was presented by Elbert C. Tabor, M.S., of the PHS Community Air Pollution Program. He discussed in detail the filtration air sampling method used by the National Air Sampling Network and the Robert A. Taft Sanitary Engineering Center.

The network sampler is a modification of a high volume filtration sampler constructed by Silverman and associates in 1948. The modified version uses a glass fiber filter web instead of the pleated cellulose filter originally used. The glass fiber material is not affected by moisture and contains no organic substances. These features avoid diffi-

Scatter diagram relating to the most probable number indexes of coliform bacteria and of enterococci of 607 samples from 595 wells





was made whereby the department does review these reports for the county map officer.

Leland is of the opinion that it is not realistic to ask developers to submit results of percolation tests when these results determine whether a plat is accepted or a building permit issued. He felt that health department sanitary engineers and sanitarians should run all percolation tests. But many agencies other than the county department of public health are concerned with sewage problems in Cook County.

### Recommendations

In 1946, the Public Health Service recommended that water supply and sewage disposal activities in the unincorporated areas of the county be transferred to the county department of public health. No action has been taken on this proposal to date, according to Leland.

A recommendation to the Cook County Board of Commissioners that only lots of 20,000 sq. ft. minimum

size be allowed septic tank systems was opposed by builders who argued for consideration of each area on its own merits. This recommendation was not adopted, but the board of commissioners decided to call a hearing at which experts were to present facts on the problem.

As a result of this hearing, a special committee was appointed in 1955 to review the entire situation and to submit legislative recommendations. In addition, several county commissioners made personal investigations and decided emergency action was needed.

All these and other recent activities have successfully induced developers to consider the installation of public sanitary sewers systems with connections to an interceptor sewer or to a community sewage treatment works. Consulting engineers are developing cost data for such facilities which they claim can be installed in average sized subdivisions for a gross cost not greater than the combined cost of individual systems.

program, Sachs maintained. She urged the experienced public health practitioner not to be deterred by the complexity of nuclear physics from applying his skills to the management of ionizing radiations.

The basic epidemiological concepts of agent, host, and environment can be adapted to the problems of radiological health, she stated. Providing expert guidance are the recommendations of the National Committee on Radiation Protection, which are available in National Bureau of Standards handbooks. These cover technical procedures for measuring radiation, methods for protection against it, and permissible exposures.

As a nucleus for a radiological health team, Sachs suggested the following: a physician from the tuberculosis or cancer control program or the occupational health group, an industrial hygiene engineer, and a sanitary engineer. Short training courses will greatly assist in bringing the radiation team to top efficiency, she stated.

### The Environment

Control of the environment, Sachs said, is the most fruitful field of endeavor in protecting against harmful effects of radiation.

Shielding, restriction of exposure time, distance, containment, adequate ventilation, proper disposal of radioactive wastes, and protective clothing and equipment are effective barriers to agent-host interaction, she noted.

The availability of these measures, however, does not guarantee that they are always employed in the manner and to the extent necessary to provide full protection, Sachs stated. It is her opinion that some community agency must provide radiation users with the advice and encouragement needed to conserve the public health.

So far, it does not seem possible to alter the host, as by an immunizing process, although in some instances the host can be selected. Sachs remarked that a careful medical history, blood counts, and physi-

## Radiological Health . . .

### State-Local Help Needed In Radiation Protection

State and local health departments have a wide area of responsibility in radiological health, asserted Miriam Sachs, M.D., chief of the bureau of adult and occupational health, New Jersey State Department of Health, Trenton.

The Atomic Energy Commission's radiation protection system includes strict regulations governing reactor-produced radioisotopes, but the commission does not control X-ray machines, fluoroscopes, naturally occurring radioactive materials, or most nonreactor-produced radioisotopes, she explained.

In recent years, the use of X-radia-

tion and natural sources of gamma radiation, as well as the availability of atomic-pile-produced radioisotopes, has increased, she declared. In many industrial plants, research laboratories, and hospitals the total exposure to radiation includes radiations from X-ray machines, radium, and manmade radioisotopes.

Sachs pointed out that although radiation sources are potential hazards they need not be serious in practical use. Radiation protection, she emphasized, should be thought of not as prohibition of use but as encouragement of use with proper precautions based on respect for possible injurious effects.

Every well-organized health department has the facilities and personnel to begin a radiological health

# Milk, Fish, Fruit Juice Tests . . .

## Not All Juice Coliforms Stem From Processing

Coliform bacteria in frozen concentrated orange juice are not necessarily an indication of direct contamination, stated E. R. Wolford, B.S., bacteriologist, Western Utilization Research Branch, United States Department of Agriculture, Puyallup, Wash.

Despite the best possible sanitary practice during production, these organisms will occur occasionally, he said. Nevertheless, millions of gallons of frozen orange juice have been consumed since 1916 without any enteric infection reported.

The presence of *Escherichia coli* in concentrated orange juice should not be condoned, Wolford emphasized, but "to condemn the product on the basis of water standards or carbonated beverage standards could

deprive the public of a wholesome, essential food."

### Coliform Sources

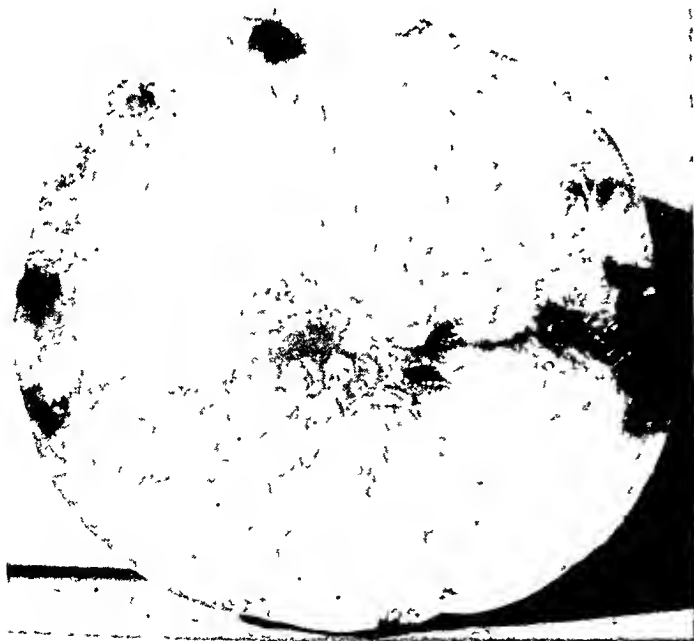
Reporting on his investigations into the sources and possible significance of coliforms in citrus fruit products, Wolford said that apparently some coliforms are present among the normal flora in orange groves. The fruit examined in the study was picked aseptically into sterile bags or was transferred to sterile bags from field boxes and conveyors by the use of sterilized tongs. The bags were closed and stapled and remained so until they were opened in the laboratory. Nevertheless, *Aerobacter* was found on seven samples of oranges, some of which were grown in groves where no organic fertilizer had been used for 3 years. *E. coli* was found in a sample of fruit from a grove which had been fertilized with barnyard

fertilizer shortly before the fruit was picked.

Packinghouse wash-tank solutions may be one of the principal sources of coliforms in frozen orange juice products, Wolford continued. These solutions may contain many coliforms, including *E. coli*, he said, and, although all oranges used for juice are rewashed at the concentrate plant, fruit with breaks in the peel, particularly weak fruit picked late in the season, may have absorbed some of the contaminated solution at the packinghouse (see photograph). Most packinghouses use these solutions more than once. In some, they are changed once a week; in others, once a season.

Procedures for cleaning fruit also differ among packinghouses. Some houses use a single tank containing both soap and borates, borates only, or soap only; others use two tanks, one containing soap solution and the other containing borates, caustics, or hypochlorite solution.

In the concentrate plants, Wolford said, coliforms were most frequently found on equipment on which decaying orange tissue had been allowed to accumulate. Coliform-positive juice and concentrate were apparently associated with the condition of the fruit itself rather than with insanitary conditions in processing, he concluded.



Penetration of dye solution into orange, indicating how wash-tank solutions can enter through breaks in rind.

## Enterococci Best Indicators In Frozen Fish Tests

Use of fecal streptococci to indicate the bacterial content of frozen fish and fish products was advocated by three faculty members of the department of bacteriology and public health, University of Massachusetts.

The testing procedures for the isolation of fecal streptococci are simpler than those using coliform bacteria as indicators, and the results are more significant, they found.

Conducting the study were Edward P. Larkin, Ph.D., instructor, Warren Litsky, Ph.D., associate research

They mentioned these: (a) the effects of interactions between soil and waste material, (b) the movement of critical nuclides through various soil formations, (c) the effects of high concentrations of stable salts on the ability of the soil to retain nuclides, and (d) the underground flow pattern of waste solutions as compared with ground-water flow.

The management of radioactive wastes may well prove to be one of the limiting factors in achieving optimum benefits from the general usage of nuclear energy, Morton and Struxness emphasized in conclusion. Helping to find rational solutions to the problems of radioactive wastes, they said, is a challenge to the sanitary engineer. He must gain an acquaintance with principles of nuclear phenomena and with the techniques of radiation monitoring and control. With regard to ground storage of radioactive wastes, he should arrive at decisions based on an understanding of the hazards and a thorough knowledge of the scientific bases for particular proposals.

## Links Radiation of Thymus To Thyroid Cancer

Indications that thyroid cancer in childhood may be associated with exposure to radiation in infancy were tentatively suggested in a study reported by C. Lenore Simpson, M.D., M.A., associate cancer research pathologist, Roswell Park Memorial Institute, Buffalo, N. Y.

This study was instigated to determine the effects of radiation in later life. Infants who received radiation to the thymus gland would be a good group for preliminary study since these children have a long life expectancy and records of X-ray treatment are readily available, Simpson said.

Accordingly, the medical histories of 1,722 children who had received radiation to the thymus between 2 and 27 years previous to the study provided the basis for this research.

She stressed that the findings thus far are all tentative.

The names of the children were obtained from the records of both hospital and private practices. Data were collected by a questionnaire sent to the parents and were supplemented by information obtained from doctors, hospitals, and State cancer records, Simpson said. Most of the children are from New York State.

Occasionally, children were interviewed personally. All available pathological reports and slides were seen. Of the original group, 1,502 were traced and information was obtained concerning 1,933 of their untreated siblings, Simpson reported.

Simpson said that the children had been treated for a variety of reasons. In some cases, thymic enlargement was suspected, and in others routine fluoroscopy of X-ray was carried out to exclude thymic enlargement either after birth or by a pediatrician attending the child later.

In many instances, Simpson related, it was not known which reason was involved in the treatment of each particular child. Generally, she said, it was assumed that the majority of these children were thought by some physician to have an enlarged thymus.

## Incidence

This study indicates, Simpson said, that the incidence of neoplasia is high among children receiving radiation to the thymus. Untreated children with enlarged thymus glands diagnosed by the same criteria would have been the preferable control group. Since this was not possible, the treated children were compared with their own untreated siblings and with the general population.

She also compared different subgroups in the study. The 220 untraced children were included in the calculations as being alive and well. The calculations, Simpson stated, have been based on the years at risk of each child and on the age- and sex-specific incidence rates of the disease. For the general population,

the 1949-51 cancer incidence rates for New York State were used, Simpson said.

In comparison with untreated children and their untreated siblings, the treated patients have a relatively high incidence of leukemia and of thyroid disease. The siblings, in the absence of known thymic enlargement and radiation, were considered, Simpson said, a good control group from the point of view of heredity and environment.

## Groupings

The study group was divided into six subgroups that represent the different sources of material. The differences in the incidence of tumors among the subgroups was studied and it was concluded that the large number of cases in one of these subgroups was not related to "chance," Simpson said.

The type of treatment in this subgroup differed considerably from that of the other subgroups and it was hoped that this might help to determine whether or not the increase in incidence was due to radiation. At the time of this comparison there were so many variables, Simpson said, that only a tentative conclusion was reached.

Analysis of the treatments was difficult throughout the study, Simpson related. The dose received by the majority of the children was estimated in roentgens. The children in the previously mentioned subgroup received more roentgens than those of the other subgroups; they were also treated with larger ports than those in any other subgroup, and the treatments were at intervals of 2 weeks instead of at 1 to 2 days as they were in the other subgroups.

The relatively small number of neoplasia cases throughout the entire study precluded a definite conclusion. However, it was significant that no thyroid nodules occurred in children who received less than 200 roentgens, Simpson said, whereas, leukemia cases were broadly distributed among the dose range and subgroups.



materials as penicillin, aureomycin, terramycin, streptomycin, polymyxin B, neomycin, bacitracin, and sulfa combinations, they said. However, this test is not specific for individual antibiotics.

Experiments show that this disc assay method is sensitive to quaternary ammonium compounds only above 50 p.p.m., a level extremely unlikely in field practice, Morris and

his co-worker said. Also numerous tests to show precision of negative results on antibiotic free milk were 100-percent effective.

Undoubtedly, Morris and Cerny said, the occurrence of inhibitory characteristics is more frequent in pasteurized milk from areas where antibiotics are used for mastitis reduction without rigid laboratory and field programs.

A fairly long list with few of any particular kind of colored algae, colorless protozoa, worms, rotifers, and other organisms suggests a low biochemical oxygen demand, a low nutritive threshold, and an inorganic substrate. In such a condition, there are enough bacteria to support low numbers of ciliates and flagellates and enough nitrates and phosphates to support a small but varied chlorophyll-bearing population.

## *Blooms*

A large population of diatoms and green plankton algae with a scattering of Euglenophyceae and colored dinoflagellates often means a substantial phosphate and nitrate content, he said. Should these concentrations exceed 0.015 and 0.2 p.p.m., respectively, the green organisms may "bloom," that is, exceed 500 per milliliter. Such blooms may clog filters and affect taste and odor.

If additional organisms such as blue-green algae are added to the bloom, the biochemical oxygen demand increases and filter and odor or taste problems may become acute, said Lackey. Other undesirable effects are implied by extreme blooms, such as restrictions on the development of species other than the species chiefly responsible for the bloom. Lackey said it was highly probable that the poisoning of fish, shellfish, and crustaceans by the marine "red tide" of the Florida coast is a result of an extreme bloom.

## *Other Indicators*

If the sample contains a scant number of organisms and a preponderance of no specific type, the water contains a low mineral content and virtually no organic matter. If the water is barren, Lackey said, it might indicate the presence of toxic substances.

Predominance of anaerobic flagellates such as *Tetramitus* is a sure indication of a high organic content and no dissolved oxygen. The same, with inorganic salts, is implied by predominance of anaerobic green forms such as *Chlorogonium* and

# Water Quality Tests . . .

## Microscope Reveals Water Quality

Quick appraisal of certain water characteristics through microscopic determination of the quality and quantity of biota in samples was proposed by James B. Lackey, Ph.D., professor of sanitary science, University of Florida, Gainesville, Fla.

New emphasis has been placed on the simplicity of this method, according to Lackey, by the 10th edition of Standard Methods for the Examination of Water, Sewage and Industrial Wastes. Though only strong indications rather than positive and detailed information of the quality of the water as a health hazard are given by such a procedure, pertinent data on the general condition and corrective treatment requirements of the water are revealed.

Although the microscope method is unsatisfactory for the determination of pathogenic bacteria or parasites, it does not necessitate waiting for cultures to develop and is especially suitable for investigating the utility of nonpotable waters.

In addition, preparation and concentration of samples is relatively simple. About 500 ml. is collected and transported from the source in chilled, nontoxic containers. Most indicator organisms in such samples

can be identified in the living state or after killing with a preservative such as formalin.

Lackey preferred centrifuging 5 minutes at 2,000-2,400 r.p.m. to filtering for concentration. The amount of supernatant discarded should vary inversely with the abundance of organisms in the sample. He went on to describe the "drop method" of counting as set forth in the standard methods manual.

## *Telltale Biota*

Indicator organisms are simply listed as ciliates, green flagellates, and so on as they are met, then tabulated. "Generally speaking," Lackey said, "those organisms most favored by a given environment will be most numerous, while those adapted to the widest environmental range will occur in the greatest number of samples." The organisms found in greatest number probably represent a response to some particular characteristic of the environment.

If plankton content is high or consists largely of diatoms, it is a signal that filtration will be difficult, Lackey said. Measures for reducing unpleasant odors or tastes and boiler water slime depend upon the kinds and numbers of organisms present. Some specific trade wastes may be recognized by the microscope method.

professor, and James E. Fuller, Ph.D., research professor, in the department.

Lack of a dependable test organism and lack of standardized methods of isolation have handicapped the food industry and health agencies in the scrutiny of frozen food products, they indicated.

Comparison of the coliform bacteria and fecal streptococcus techniques was made on 80 samples of commercially packed fish and fish products, purchased from stores in several western Massachusetts cities. Seventy-five of the samples had been precooked; the rest were raw.

For the 20 fish stick samples examined, the MPN index of coliform bacteria in lactose broth ranged from 0 to 230. Most of the samples showed MPN values of less than 20. In the confirmatory brilliant green lactose bile (BGB), the values ranged from 0 to 130, most of the samples showing a zero value. The MPN values of fecal streptococci in ethyl violet azide broth ranged from 20 to 16,000 for the same samples, with most of the values more than 500.

Eighteen samples of scallops showed a similar picture. The MPN values for coliform bacteria in lactose broth ranged from 0 to 330; in BGB, from 0 to 130; and on eosin methylene blue, from 0 to 2,400.

Similar results were obtained with codfish cakes, ocean perch, crab cakes, seafood dinner, fried clams, haddock, shrimp, and lobster. Fecal streptococci were present in most of the samples, the MPN values ranging from 0 to 24,000.

Total plate counts, made on tryptone glucose extract agar, were of little value in the examination of frozen fish products, they found. Only in cases of gross bacterial contamination were the plate counts sufficiently high to cause concern. Most of the fish products tested had bacteria counts of less than 3,000 per gram, they reported.

### *Hand Blending Adequate*

In blending the samples, the effectiveness of shaking the material by hand was compared with Waring

Blendor results, a more time-consuming process recommended in tentative standard methods.

Disintegration of the materials in a blender gave more accurate results than those obtained by the hand methods. The mechanical method, they concluded, should be used when accurate estimates of bacterial numbers are desirable, but the hand method is adequate for routine testing, and better than not testing at all.

Larkin and associates concluded that the high incidence of fecal streptococci on frozen fish products, possibly attributable to breeding, should make the organism easy to isolate. In addition, these organisms, although they can be eliminated by proper food processing, are somewhat resistant to heat. Consequently, they should be a more dependable indication of inadequate processing than more heat labile organisms.

## **Antibiotic Residual in Milk Detected More Precisely**

A modification of the standard method for detecting lower level antibiotic residuals in milk was offered by Robert L. Morris, M.S., and Josephine Cerny, chief and associate chemist, respectively, of the Iowa State Hygienic Laboratory, Iowa City.

Economic losses to the dairy farmer resulting from acute and chronic mastitis in his herds have stimulated widespread use of antibiotics and better sanitation and handling practices, they said, in pointing out there has been a resulting improvement in the quality of milk as well as a reduction in the incidence of mastitis. Proper laboratory and field controls can assure antibiotic free milk, they maintained.

Morris and Cerny stressed that there is some medical opinion that continued use of low-level antibiotic residuals in milk and other foods

can result in resistances and possible allergies in the consumer, and impair the use of antibiotics against infections.

The bacterial inhibitory influence of antibiotics at the levels detected by this test casts considerable suspicion on the authenticity of standard plate counts obtained on milk samples containing demonstrable antibiotic residuals, they stated.

Morris and Cerny found that antibiotic residual tests using the technique described in the Standard Methods for the Examination of Dairy Products, 10th edition, gave nonprecise, low-level results and sensitivities to only 0.1 unit of penicillin per ml., a level which reportedly appreciably retards acid production in the manufacture of cheese. Such lack of precision in the lower levels of the standard methods test, they said, limited its value.

The modification of the antibiotic residual test consists mainly of the use of 2 one-half inch filter paper discs instead of a one-fourth inch disc.

The new double disc method is sensitive and precise to at least 0.01 unit of penicillin per ml., while the one-fourth of an inch disc procedure loses precision below 0.1 unit per ml., they observed. Penicillin ointment was used for this test.

Morris and Cerny observed that the double discs absorb about 10 times the milk volume as compared to the one-fourth of an inch discs, a factor they believed largely responsible for the greater precision. Also, it is reasonable to assume, they said, that the top disc deters evaporation of the absorbed milk and allows more complete diffusion of the sample into the agar.

They found that the large-disc modification is quite sensitive to other antibiotics and readily detects their presence in the low concentrations.

The double disc test is sensitive to low concentration levels of seven different commercially available bovine mastitis antibiotics containing such

sources and an unbiased estimate of coliform density, Hopkins and Schamberger said.

In conclusion, they stated that "the introduction of this new mathematical manipulation in existing water report procedures would not

be burdensome and the relatively simple method of establishing the central tendency density would justify its use." They were also of the opinion this procedure should be included in the Manual of Recommended Water Sanitation Practice.

The death of a man immediately following an automobile accident may be certified as an accidental death, although from the health worker's point of view, the accident may have been only incidental to the diseased condition of the heart designated by the pathologist as the primary cause of death, Treloar stated.

In addition, the pathologist may find that the man had cancer of the bladder which would undoubtedly have resulted in death in a very short time unless discovered and treated, and the man may have had arrested tuberculosis also, which was not a factor in the death and therefore was overlooked.

The record of this death could quite justifiably be claimed by several societies, Treloar said. The body is not only part of the wreckage of an accident, it is also "mute testimony to the wastage of rheumatic fever and heart disease, tuberculosis and cancer," all of which have contributed to the morbidity knowledge we seek.

## Vital Statistics . . .

### Suggests New Terminology For Causes of Death

Rewording death certificate forms so that physicians will be encouraged to report diseases rather than to indicate a single "cause" of death for statistical tabulation was the recommendation of Alan E. Treloar, Ph.D., professor of biostatistics, School of Public Health, University of Minnesota, Minneapolis.

Treloar suggested that a new and more meaningful term be used on the form, such as "terminal morbidity states" or "conterminous morbidity." The physician could, if he chose, indicate by an underline the condition or disease which he wished to emphasize.

Rates defining proportionate morbidity at time of death and expressing the number of cases of each disease state as a proportion of all deaths would be more informative and would cover disease conditions preceding death more completely than the presently used rate based on a specific cause, Treloar continued.

The prime interest of public health workers is in morbidity; their responsibilities require them to know as much as possible about the total morbidity picture in their communities, Treloar stated.

It is "our challenge to action; mortality is merely a measure of our defeat. Medical certification of cause of death is helpful in determining morbidity but as yet even

the best mortality records give only a grossly biased sample of morbidity conditions in a total community," he said. If complete morbidity data for each community were readily available, "our interest in cause of death certification would surely vanish," he stated.

#### *Selecting the Cause*

The selection of one disease or condition as the primary cause of death is an arbitrary act and is influenced by the viewpoint of the person making the selection, Treloar said. The vital statistician will seek a specific cause for statistical tabulation; each national society will contend for the assignment of each death to its particular category to add weight to its plea for funds; the lawyer will be interested in the legal aspects of death; and the insurance executive will consider the obligations of his company.

#### *Clinical vs. Autopsy Findings*

Treloar suggested that a specified cause is only one of infinite numbers of members of causal systems and that the so-called cause of death may be only one of many factors. For example, when death results from a chronic disease, the apparently clear-cut syndrome of clinical symptoms which give the internist confidence in assigning the cause of death do not always agree with the autopsy findings. The pathologist would often insist on some other entry on the death certificate if it were not already completed and filed, Treloar said.

### Lowest Total Death Rate Found in Suburbs

Residents of metropolitan rural areas have a lower total death rate, on the whole, than the population of urban or nonmetropolitan rural areas, although the mortality experiences of different age groups vary.

Although they enjoy the most favorable mortality experience, suburbanites of the metropolitan rural counties, combining the advantages of urban and rural life, lose their advantage by middle life. Factors related in some way to the urban aspects of their lives seems responsible for this shift.

These inferences were drawn from a 1949-51 study of differential mortality according to the degree of urbanization in New York State (exclusive of New York City). The findings were reported by Elizabeth Parkhurst, M.S., biostatistician, New York State Department of Health,

certain *Euglena*. An excessive number of ciliates, he said, indicates a high bacterial population, which in turn means organic contamination.

Examination of slides at a magnification of about 430 diameters also points to the speed and stage of oxidation of organic matter to inorganic ions in the water. Large numbers of free living bacteria and *Zooplca ramigera* respectively denote initial and active stages of oxidation; fewer bacteria but many green flagellates and some ciliates, oxidation nearly complete; and great quantities of nonflagellated green algae with some ciliates and stalked bacteria, complete mineralization.

In concluding, Lackey emphasized the need for caution in interpreting such data in view of the lack of information on the ecology of many micro-organisms.

## Problem of Fluid Samples Solved by New MF Test

A delayed incubation procedure, using the membrane filter, was suggested by four Public Health Service bacteriologists for examining the coliform content of water when shipment of refrigerated fluid samples is impossible or impractical.

Many laboratories serving large geographic areas have been unable to comply with the recommended 12-hour limit for commencing bacteriological examination of relatively pure water samples, maintained between 6° and 10° C., they explained.

Reporting the procedure and the trial results were Edwin E. Geldreich, M.S., Paul W. Kabler, M.D., Ph.D., Harold L. Jeter, M.A., and Harold F. Clark, M.A., all with Water Supply and Water Pollution Control Research, Robert A. Taft Sanitary Engineering Center.

The new procedure permits the bacterial examination to begin at the time of collection, they reported.

An appropriate quantity of water is filtered through the membrane at the sample collection site, and the

membrane is placed on a preservative medium. The individual petri dishes are wrapped in Parafilm to minimize evaporation and are shipped, unrefrigerated, to a laboratory for completion of the bacterial examination.

Isolating the organisms on a solid surface removes the possibility of coliform increases by cellular multiplication, and each cell theoretically becomes a countable colony, they said. Other advantages named were decreased weight per sample, small size, low cost of sample container, and transportation to the laboratory by first class or air mail without refrigeration.

## Test Results

In testing the new procedure, coliform densities in water samples estimated after storage on the MF preservative medium at room temperature (13° to 32° C.), and at 35° C. for 24, 48, and 72 hours were compared with the standard methods MPN determinations on liquid samples stored at 5° C., 13° to 32° C., and 35° C. for the same time periods. Both were compared with results from an initial 5-tube, 3-dilution MPN test.

Samples were taken from 6 sources, 3 rivers, 2 farm wells, and a lake. Three samples from each source were examined in a winter and a summer series.

The preserved MF coliform counts at room temperature, they found, indicated good agreement with the MPN densities in liquid samples stored for 24 hours at 5° C., but they tended to be lower than the initial MPN.

The preserved MF results at room temperature and at 35° C. were superior to the MPN procedures on liquid samples stored more than 24 hours at the same ambient temperatures, they reported.

The MPN coliform counts on liquid samples held at 5° C. for periods up to 72 hours were quite variable, they said, but they more closely approximated the initial MPN results than those for samples stored at the higher temperatures.

## Baltimore Coliform Count Uses Geometric Mean

The geometric mean is a more accurate measure of the density of coliform organisms in water supplies and streams than the arithmetic mean, or average of daily counts, stated Edward S. Hopkins, consulting sanitary engineer, and Karl H. Schamberger, principal associate engineer, bureau of water supply, Baltimore, Md.

Hopkins and Schamberger said that one or two extremely high daily counts reported during a month distort the arithmetic mean so that it does not represent general conditions for the period. Zero and a count of millions have equal weight in computing an average, they pointed out. The average, then, is not a true measure of central tendency, they said. They defined "central tendency" as "a single measure that is representative of a group of measures." This single measure could be the median, the geometric mean, or the arithmetic mean.

When bacterial counts are normally distributed, the arithmetic mean will give an unbiased estimate of coliform density and minimum variance, but one or two very high or very low counts will distort this figure so that it will not accurately represent general conditions and may give a value which is misleading, Hopkins and Schamberger said.

The geometric mean, or average of logarithmic values, on the other hand, equalizes high and low measures and is a precise measure of central tendency, they stated.

## A Simple Method

Most water purification plants report daily coliform density and a monthly average of the daily figures. It would not be difficult to add to the report form a column showing the logarithmic value of the daily counts and to show the average of these values, or the geometric mean, in another column following the monthly average and its logarithmic value. This would provide a more uniform relationship between data from the same stream or data from various

# CAUSE DATA

**Resident death rates per 1,000 population by sex and age in the urban and rural subdivisions of counties suburban to New York City, and of the total of all other metropolitan areas of New York State, exclusive of New York City, 1949-51**

Sex and age	Nassau, Rockland, Suffolk, and Westchester Counties		Upstate metropolitan areas		
	Places 10,000 and over	Places under 10,000	Central cities	Other places 10,000 and over	Places under 10,000
Total, both sexes, adjusted.....	8.4	8.2	9.4	9.3	7.9
<i>Males</i>					
Total, adjusted.....	9.7	9.3	11.0	10.6	8.8
Under 5 years.....	6.2	5.5	7.4	7.1	6.4
5-14.....	.6	.5	.6	.5	.6
15-24.....	1.3	1.2	1.1	1.1	1.5
25-34.....	1.8	1.4	1.7	1.8	1.4
35-44.....	3.5	3.3	4.6	4.2	2.9
45-54.....	9.4	9.1	12.4	11.3	8.4
55-64.....	23.5	24.6	28.5	26.9	21.3
65-74.....	53.9	51.9	57.7	57.0	47.7
75 years and over.....	129.1	118.7	134.2	137.4	120.6
<i>Females</i>					
Total, adjusted.....	7.2	7.2	7.9	8.0	6.9
Under 5 years.....	4.7	4.3	5.8	4.8	4.8
5-14.....	.4	.3	.4	.5	.4
15-24.....	.6	.6	.6	.7	.6
25-34.....	1.2	1.0	1.2	1.3	.9
35-44.....	2.6	2.4	2.8	2.7	2.0
45-54.....	6.2	5.9	6.7	7.1	5.8
55-64.....	14.4	14.0	16.3	16.2	13.4
65-74.....	36.5	34.7	38.4	40.6	34.7
75 years and over.....	103.2	112.4	115.3	113.6	106.4

in the metropolitan than in the non-metropolitan rural areas, she stated.

Part of the excess mortality among older adults in the cities and suburbs may be due to higher death rates from arteriosclerotic heart disease, which were 31 percent higher in cities over 50,000 than in nonmetropolitan rural areas, Parkhurst said. However, this differential in the cause of death may reflect superior diagnosis of coronary disease in the cities, she concluded, since the death rate from all forms of heart disease was only 23 percent higher in cities over 50,000 than in nonmetropolitan rural areas and, from all cardiovascular diseases as a group, only

12 percent higher, because of lower rates for vascular lesions and nephritis.

## Seeks Constructive Ideas For Mortality Studies

What are the specific needs not now being met that should be met by cause-of-death statistics?

It is high time that less attention is paid to what is wrong with cause-of-death statistics and more work devoted to constructive answers to this question, said Iwao Moriyama, Ph.D., chief, Mortality Analysis Sec-

tion, National Office of Vital Statistics, Public Health Service.

Once the needs are determined and agreed upon, the next step will be to examine the elements that go into mortality statistics. It should be possible, he said, to alter one or more of the following: the basic medical information supplied by the physician, the method of reporting, the classification list of diseases, and the method of selecting causes to be tabulated.

The increase in public health importance of the chronic diseases is one reason for the growing indication of inadequacy in current mortality statistics, Moriyama implied. He pointed out that the traditional compilations, despite their limitations, have proved of value in the past when public health was concerned chiefly with infective diseases.

The nature of mortality data is one factor limiting the uses of mortality statistics, according to Moriyama. Cause-of-death statistics are descriptive of the illnesses and injuries of the population that has died, but they cannot serve as reliable indicators of morbidity unless the fatality rates for the different morbid conditions are known or are known not to vary greatly from time to time or place to place, he noted.

Moreover, the underlying cause of death—the basis for current compilations of mortality statistics—may be a disease or condition not present at the time of death. Hence, it is difficult to see how the concept of the underlying cause of death fits within the framework of any morbidity survey, he declared.

For the study of morbidity, Moriyama suggested that it may be useful to obtain information on all the diseases afflicting the deceased at the time of death, with some distinction between those associated with the death and those not associated.

## Quality and Classification

Another limiting factor is inaccuracy in clinical diagnoses and in reporting causes of death. Mori-

Albany, N. Y. The United States Census Bureau's identification of metropolitan districts, associated with towns of 50,000 or more, was used to distinguish metropolitan from nonmetropolitan areas.

Parkhurst said the study indicated that "the large cities appear to have evolved an environment into which children are born and grow up at no disadvantage, and even at some advantage to their rural cousins. The mortality experience of the adult population, however, is far less favorable in the cities than in the rural areas, and more so in the metropolitan than in the nonmetropolitan cities."

In rural areas, the death rate from accidents among males aged 5-14 and 15-24 years (one-half and two-thirds, respectively, of deaths from all causes) accounts for much of the metropolitan advantage.

### Young Adults

In the metropolitan rural areas mortality among young persons aged 15-24 is higher than in the cities. This may be attributed to the migration of many young persons, particularly young women, from suburban and rural areas to the cities, Parkhurst stated. Since those who are ill remain at home, this factor may account for the higher death rate for

females in this age group in areas outside large cities, she said.

In suburban areas, the death rates, particularly among males, are lower than in central cities, Parkhurst said. This is probably due, not only to the higher standard of living in the suburbs, but also to the fact that the suburban population is made up of men with families. Married men as a group have a much lower death rate than the single, the widowed, and the divorced, who usually live in cities, she noted.

### Older Adults

For women between the ages of 45 and 75 and for men between the ages of 55 and 75, death rates are higher

Resident death rates per 1,000 population in metropolitan and nonmetropolitan urban and rural areas, New York State exclusive of New York City, by sex and age, 1949-51

Sex and age	New York State exclusive of New York City	Metropolitan areas				Nonmetropolitan areas		
		Total	Central cities	Other places 10,000 and over	Places under 10,000	Total	Places 10,000 and over	Places under 10,000
Total, both sexes, adjusted <sup>1</sup> .....	8.4	8.7	9.4	8.7	8.0	8.5	9.0	8.4
<i>Males</i>								
Total, adjusted <sup>1</sup> .....	9.6	10.0	11.0	10.0	9.0	9.7	10.4	9.4
Under 5 years.....	6.8	6.5	7.4	6.5	5.9	7.3	7.6	7.2
5-14.....	.7	.6	.6	.5	.6	.8	.7	.8
15-24.....	1.4	1.3	1.1	1.3	1.4	1.6	1.2	1.7
25-34.....	1.7	1.6	1.7	1.8	1.4	1.9	1.7	2.0
35-44.....	3.6	3.7	4.6	3.7	3.1	3.7	4.0	3.5
45-54.....	9.9	10.3	12.4	9.9	8.8	9.7	11.0	9.2
55-64.....	24.0	25.5	28.5	24.6	22.9	23.1	26.3	21.8
65-74.....	51.4	54.0	57.7	54.9	49.7	51.2	56.4	49.3
75 years and over.....	123.9	127.5	134.2	131.6	119.8	127.7	127.5	127.8
<i>Females</i>								
Total, adjusted <sup>1</sup> .....	7.3	7.5	7.9	7.5	7.0	7.4	7.6	7.3
Under 5 years.....	5.3	5.0	5.8	4.7	4.6	5.8	5.9	5.8
5-14.....	.4	.4	.4	.4	.4	.4	.5	.4
15-24.....	.7	.6	.6	.6	.6	.7	.6	.8
25-34.....	1.1	1.1	1.2	1.3	.9	1.2	1.1	1.2
35-44.....	2.5	2.5	2.8	2.6	2.2	2.6	2.7	2.6
45-54.....	6.1	6.3	6.7	6.4	5.9	6.0	6.3	5.8
55-64.....	14.3	15.0	16.3	15.0	13.7	13.8	14.9	13.4
65-74.....	35.3	36.9	38.4	37.7	34.7	35.3	36.8	34.6
75 years and over.....	107.6	111.1	115.3	108.0	109.2	112.0	112.0	112.0

<sup>1</sup> Standardized, by direct method, to the age distribution of the population of New York State in the census of 1940.

"Many of the persons whom public health nurses and social workers seek to serve are patients or clients being asked to move from narrow self-contained environments into a larger cultural milieu of which scientific health practices and elaborate treatment centers are a component," Brown stressed. "How can it be hoped that persons limited by educational or social experience or by prejudice, real or imagined, will be able to make such a move without putting a severe strain on their patterns of psychological adjustment and hence on their mental health?"

They will need help, Brown asserted, but help of a kind they can accept. The public health nurse is in a strategic position to give that help, she concluded.

## *Interpersonal Relationships*

From the mental health viewpoint, current nurses' training programs do not facilitate optimal development of the skills and experiences essential to understanding of and proficiency in interpersonal processes, according to Stephen Fleck, M.D., associate professor of psychiatry and public health, Yale University School of Medicine, New Haven, Conn.

Fleck, in his contribution to the discussion, added that the public health nurse needs to discern and understand quickly the character of interpersonal relationships in groups of people, in addition to prompt recognition of individual maladjustment. Preparation for this must pervade the entire training program, undergraduate and graduate, Fleck said.

The role of the public health nurse in mental health is determined by administrative planning and action, according to Mary King Kneidler, R.N., B.S., M.A., chief of the public health nursing section of the North Carolina State Board of Health, Raleigh, N. C.

Kneidler stated that this includes the setting of objectives and the course of action; coordination of personnel within the agency and coordination of the program with that of

other agencies involved in a mental health program; and staff education in the area of mental health.

## **Nurses Evaluate Own Role In Adult Home Program**

Forty Kansas nurses expressed varying feelings about their part in the licensing of adult boarding homes and made a number of suggestions for improving the program, reported Lucille E. Tracy, R.N., B.S., director, public health nursing, Wichita-Sedgwick County Department of Public Health, Wichita, Kans. Tracy summarized representative replies to an opinion poll of 72 public health nurses, supervisors, and staff nurses as follows:

### *Favorable Effects*

From the standpoint of care of the boarding home residents, the nurses felt that the licensing program had improved the safety of medication and other treatments.

Home administrators have learned the professional nurse's concept of nursing as the art of giving care and medications to the sick under medical supervision. Administrators have been taught to observe patients professionally and to improve the records of their observations.

They have also introduced additional safety measures such as hand rails in tubs and showers and on stairs.

Those in charge of patients have been helped to see emotional as well as physical needs of patients. More thought has been given to rehabilitation and more activity has been provided for residents.

The support from the local health agency has given administrators more confidence, an opportunity to discuss problems, and an awareness that others are interested in their work.

The area of supervision for nurses has been extended by this experience. They have gained insight into the problems of the aging, the nurs-

ing needs of elderly sick persons, and of the impact of family relationships and their effect on older persons. They have also learned what happens to elderly persons who have no family.

Nurses have increased their skills in teaching, writing reports, interviewing, and counseling and have applied safety measures in public health nursing. Working relationships between the health department and other welfare agencies have been improved. Opportunities for both group and individual teaching of nursing procedures and techniques have been ample.

The need for standards for nursing homes is gaining recognition and acceptance in the community. Also, local health and welfare departments have been given opportunities through this program to work together on improvement of mental health.

### *Unfavorable Effects*

The licensing nurse represents an authoritative and judgmental figure to the nursing home administrator, who may find it difficult to recognize the nurse in a guidance role. A great deal of time and careful work is needed to change the administrator's viewpoint so that the public health nurse will be consulted and will be thought of as an ally and not as an investigator or law enforcement agent.

Acting as an evaluator is counter to the nurses' principle of accepting people as they are and of working on problems which they regard as of foremost importance. Overlapping of authority has created some confusion for both nurses and administrators. Some nurses are reluctant to work with welfare workers, and others feel that their evaluations are not given enough recognition by the State health department.

### *Suggestions for Improvement*

Careful consideration should be given to the question of whether or not the nurse is serving in her best capacity when she acts as an evalu-

yama cited several studies which he said have shown lack of agreement between causes of death based on clinical information and causes based on autopsy information, particularly for the so-called clinical diseases, such as hypertension and diabetes.

There is no question that there is room for improvement in the quality of medical certification, he admitted. However, he considers it "altogether unreasonable to expect absolute precision in diagnoses involved in death." The most that can be expected from cause-of-death statistics is that they reflect as accurately as possible the average current medical opinion based on all available information, he said.

The classification scheme, which largely determines how diseases are grouped and how much detail can be obtained, might be considered a third limiting factor, Moriyama indicated. Certain sections of the classification list are recognized as "not particularly satisfactory," he pointed out. With reference to the section

on circulatory diseases, he urged more studies of the problem of the cardiovascular-renal diseases in preparation for the eighth revision of the International Lists in 1965.

A fourth factor definitely limiting the usefulness of mortality statistics is the method of classification. The underlying cause-of-death concept has had great utility, but not all needs for cause-of-death statistics are concerned with the underlying cause, he stated. For example, there are expressed needs for data that would describe a disease complex or the relationship between the diseases that led to death, and there is a need for information on the therapeutic misadventures and untoward effects of drugs.

Moriyama mentioned that experimental studies on the tabulation of multiple causes of death have been conducted, but that as yet little or no attention has been given to the uses and meanings of such tabulations.

terus of behavior, the nurse's own included, are conditioned by educational, economic, religious, racial, national, and geographic backgrounds, Brown declared.

Recently, she reported, schools and organizations have become increasingly aware of the potential application in the health field of this type of knowledge. To this end, the Russell Sage Foundation, among other organizations and individual scientists, are trying to provide a literature designed for use by public health workers and by schools training health workers.

### *Specific to Situation*

"The larger question remains," she went on, "of how the facts about social and cultural factors and their interpretation can be made specific enough for application in a wide variety of clinical or health-teaching situations throughout the country."

"What is needed," she said, "are data that furnish the worker with some immediate guide to attitudes toward sickness, medical personnel, clinics, hospitals, health as a positive goal, which may be expected in a particular type of patient, family or community; data that provide clues about how a relationship could be established that might otherwise be impossible."

Before literature of such dimensions is available, Brown said, years of collecting, analyzing, and interpreting of materials will be required. However, she pointed to important beginnings that have been made; for example, the current study of all patients using the comprehensive general clinic of the Denver General Hospital. One-third of the patients are of Mexican or Spanish-American descent. A sample of the clinic patients will be followed into their homes and community while a study of physician-patient relationship is conducted at the clinic through the medium of a oneway screen. This study may give some indications of the particular social and cultural factors significant in the therapeutic process, she said.

## Public Health Nursing . . .

### **Studies of Attitudes May Shape Training**

Public health nurses, particularly those concerned with mental health, will have a valuable instrument in studies which interpret data pinpointing individual as well as group attitudes, in the opinion of Esther Lucile Brown, Ph.D., an executive of the Russell Sage Foundation, New York.

From such interpretive studies nurses may learn how attitudes can be altered for constructive purposes.

In her discussion of the contribution of the behavior sciences to understanding in public health nursing, Brown raised two fundamental questions:

How can understanding by the public health nurse of the patient and his needs, or the family or community and its needs be developed?

How can such understanding be used for therapy, prevention of mental as well as physical disease, and teaching of positive health?

The gains made in understanding the personality structure by psychiatry, psychology, and the social sciences have not yet been sufficient to equip the public health nurse entirely to meet problems arising in the treatment of persons who have different linguistic, social, and economic backgrounds, she said.

If the nurse is to view the patient in relation to his family or community matrix, much more must be known about how attitudes and pat-



tural backgrounds. All but three were staff level nurses.

## Group Education

Leadership training focused on parent group education, the objective being to help parents become better parents rather than better group members. It is a complex method, Auerbach stated. Leadership cannot be acquired quickly or established by resorting to easy devices. The group leader develops the discussion from the experiences of the parents as they look at their family problems with their peers.

The decision to prepare nurses for the application of discussion methods to work first with parents of growing children, and only thereafter with expectant parents, was made to see whether they could acquire leadership skills more easily in an area in which they had not functioned before, Auerbach said. Once the nurses felt comfortable when using the newly developed techniques, they might apply them flexibly elsewhere, it was thought.

Because the program was a pilot study and because the training group was a small one, the results are only suggestive of what further research may find.

On the significance of the nursing program for nursing education—suggesting the possibility of changes in teaching methods, in selection of students, and in curriculums of nursing schools, Auerbach stated:

"The study suggests chiefly that these nurses were not as adequately prepared as might have been expected with regard to certain important aspects of child development and parent-child relationships which, certainly, pervade all phases of their work, whether they are working with parents in groups or seeing parents and/or children in clinic conferences or home visits."

The skills of parent group education based on the discussion method can be acquired, with special training, by public health nurses, but not all members of any professional group may be expected to lead groups with equal effectiveness,

Auerbach remarked. As a professional group, nurses brought to this work certain assets and limitations, out of their general professional training. Vocationally, they are in a strategic position to serve as leaders of parent groups.

## Assets, Liabilities

Among the assets cited by Auerbach were the following: thorough knowledge of certain phases of individual growth and family needs, particularly the physical side in health and in illness; sympathy for children's needs; close contact with the community's families; knowledge of community resources for personal and health services; some knowledge of the group discussion method; conscientious and responsible attitude toward acquiring new skills and toward using themselves in a disciplined, professional way; acceptance of supervision, including being observed in action.

Among the limitations, she listed: lack of sufficient knowledge in child growth and development and in family relations; insufficient knowledge of dynamics of behavior, individually and in groups; limited diagnostic awareness of pathology in child behavior and parental attitudes; little familiarity with cultural variations in child care attitudes and practices; little practical

knowledge of group techniques; limited knowledge and acceptance of their active role in individual supervisory conferences.

She added that the findings did not throw any additional light on the selection of trainees although correlations of personality trends and performance ratings did indicate that the more authoritarian the nurse, the less effective her teaching by the group method. Auerbach also remarked that study is needed of intelligence levels, flexibility, emotional maturity, and other personality factors.

For new programs of this type to be effective, she concluded, nurses need staff support in recruiting interested parents and in arranging their workload so they can give sufficient attention to the organization and conduct of their groups.

To consolidate the program described, New York State has a threefold program now in progress, Auerbach reported. This includes supervision of the first group of nurses in the conduct of second parent groups and antepartum groups, a new complete project for public health nurses, and a training program for hospital nurses for work with groups of expectant parents. The research project is being continued, she said, to help evaluate the two new training projects.

# Physician Distribution . . .

## Low-Income, Rural Areas Report Loss of Physicians

The difficulties faced by rural communities in their attempts to attract and keep physicians will become more serious in the future, stated Milton Terris, M.D., M.P.H., and Mary A. Monk, Ph.D., of the University of Buffalo, Buffalo, N. Y.

Dr. Terris is assistant dean for postgraduate education and associate professor of preventive medicine and public health, School of Medicine. Dr. Monk is research associate in postgraduate education and instructor in medical statistics, School of Medicine, and lecturer in social psychology, College of Arts and Sciences.

The national trend in the distri-

ator. If she is, she needs continued help to accept and fulfill that role.

Demonstration days, when administrators can show each other special rehabilitation techniques would be helpful.

Criteria should be developed to evaluate the mental capacity, ability, skill, and understanding of the prospective boarding home administrator.

More conferences are needed between agencies and administrators working on specific problems.

Presenting standards to the evaluators before they are presented to the administrators would help to eliminate many of the frustrations which develop when the standards are presented to the administrators.

When standards are adopted they should apply for a reasonable length of time.

All boarding homes should be licensed, including private boarding homes.

## Kansas Nurses Participate In Adult Home Program

Public health nurses are taking an important part in the adult boarding home program in Kansas, but they still need help in adjusting to the role of evaluator, according to Roberta E. Foote, R.N., M.A., director, public health nursing, division of local health services, Kansas State Board of Health, Topeka, Kans.

When Kansas gave health departments an official part in licensing nursing homes in 1951, public health nurses were reluctant to participate in the program, Foote continued. They did not wish to be regarded as inspectors.

Nevertheless, the nurses believed that they should participate in formulating standards for care and treatment of ill or elderly persons, in helping operators of boarding homes care for their patients, and in evaluating services and structures, Foote stated. They also felt that it would be good nursing practice to care for and to champion the cause of elderly people who are helpless

or ill and that, by visiting nursing and boarding homes, they could teach nursing procedures to the administrators. However, in describing their part in the program, they changed the word "inspection" to "evaluation."

## Standards of Care

Although elderly and ill persons are only a small part of the Kansas population, they are helpless as individuals and have many physical handicaps. Public health nurses can do much to close the gap between knowing what should be done and what actually is done in caring for them, Foote asserted.

Nurses have always observed or "inspected" symptoms and environment and have learned to evaluate the work of students and staff in a cooperative and constructive spirit, and "we can and do evaluate the adult boarding homes in the same spirit," Foote said.

Many nurses are overcoming their fear and dislike of appearing as witnesses at formal hearings, she stated, although they do everything they can to prevent court hearings. They know that most administrators of boarding homes are as interested as the nurses in giving good care to the residents and, before court hearings are held, the nurses ask the licensing agency to arrange for informal conferences between the administrator and the licensing agency to find ways to help the administrator meet the agency's standards for the homes.

Concern for the improvement of standards of institutional care has increased in the past 10 years, Foote stated. Before 1947, only 4 of 46 States reported legislation on institutions for older people, whereas during 1947-50, 18 States passed this type of legislation.

At times it has seemed as if "the licensing programs were overshadowing everything else," but "the facts do not bear this out," Foote stated. It is estimated that in the agency having the largest number of homes under its supervision, the li-

censing program took only about 2 percent of the nurses' time and less than 2 percent of their visits. Lucille Tracy, of the Wichita-Sedgwick County Health Department, is the public health nursing director of this agency. Her summary of the opinion poll of public health nursing personnel precedes this presentation.

As a result of the licensing program, better teamwork has developed within the health department and between the health department and other agencies, she concluded.

## New York Nurses Train To Lead Parent Groups

When the Child Study Association of America, at the request of health authorities, undertook to train 15 public health nurses as leaders of parent discussion groups, it embarked on pilot research which could influence the content of public health nursing education. Whether the findings have any bearing on nurses' training, said Aline B. Anerbach, depends on how extensively one defines the goals in nursing education.

Mrs. Anerbach, director of the association's leadership training department, described the experiment begun in March 1954 for the New York State Health Department with the sponsorship of the Children's Bureau of the Department of Health, Education, and Welfare.

The project consisted of 13 weeks' preliminary training in the content of parent group education and techniques of leadership, followed by work in the field under health department auspices and supervised by the association's staff.

A faculty representing the disciplines of psychiatry, research and clinical psychology, education, and cultural anthropology participated in the intensive training program of theory, observation, and group seminar work. A research advisory committee followed progress of the project and evaluated the responses of the nurses to the program. Trainees came from different cul-

## Council's Efforts Improve Physician Distribution

The Virginia Council on Health and Medical Care can almost guarantee a physician for a community if the community wants one, needs one, and is willing to work for one, according to Edgar J. Fisher, Jr.

Fisher, director of the council, reported that success of the organization's physician placement service can be attributed largely to its background work with medical students and interns. Since the service began in 1950, 120 physicians have been placed, significantly improving the physician distribution problem in the State as well as providing physicians for smaller communities, Fisher said.

The Virginia council has directed primary attention to the needs of the Medical College of Virginia and the Medical School at the University of Virginia. Support has been given to better salaries for professors, training facilities, and other needs. In addition, 50 medical, 4 dental, and 74 nursing school scholarships are offered annually to students pledging a year of rural practice for each year the scholarship is held.

### Rotating Intern Program

Fisher said that the rotating intern program which the council helped promote assists rural hospitals in meeting personnel shortages as well as providing valuable training. The interns are assigned to 6 small hospitals in outlying communities for a 2 to 3 month tour of duty under the supervision of their medical school professors, who make periodic visits to the hospitals.

Junior medical students each fall receive from the council a letter that explains the placement service and offers material descriptive of rural practice. Senior students receive a reminder of the service and, after they become interns, they receive another letter from the council which includes a questionnaire to be returned if the student desires to be placed on the list of available candi-

dates. Out-of-state school students also are assisted to find rural practices. At monthly seminars held at the University of Virginia, rural practice is informally discussed with students.

### Services Mutual

"We do all we can to make it easy as possible for a physician to find the type of practice he is looking for," Fisher said. The physicians are sent lists of communities needing physicians and the communities are provided with lists of general practitioners and specialists seeking placement and usually the type of opportunity or skill sought can be provided.

Community requests for help are investigated by the council to establish the need and ability of the area to support a physician. Sometimes requests are turned down but after a request has been cleared, a personal visit is made to the community and it is instructed in the methods of seeking a physician. Experiences of other areas are shared with it, methods of financing clinics are explained, and ways in which to make a community attractive for a physician are detailed.

"The council will help a community to the extent that the community wants to be helped," Fisher stated, pointing out that there were 50 communities then seeking general practitioners and there were 80

available. Specialists were called for in 24 places and 100 were listed as available.

Recently Virginia has set up a dental placement service, as the need for dentists is considered even more acute than the need for physicians. A clearinghouse program for medical technologists is in the planning stage.

### Human Relations

Fisher said the program brought out some interesting facts in human relations. Young physicians frequently fail to reply to correspondence, fail to keep specific appointments with communities, and often consider they are doing the community a favor when they locate. Many fail to put roots into the community of choice, and then blame their wives when problems arise. Often they are unappreciative, or unaware, of what the community has done to help them get started.

The attitude of some communities is also disturbing, Fisher reported. Some fail to live up to promises made the new physician; many do not consider his time and his privacy. In many areas, the new physician is called in only for emergencies and night cases. He advised communities to avoid gossip and unjustified criticism of the physician and his family, to respect posted office hours, to avoid raising the price of property a physician seeks to buy.

## Trends in Nutrition . . .

### Better "Convenience Foods" Predicted for Future

The housewife will have less to do and the food processor more in the preparation of foods for the table.

This was the prediction for the future made by Horace K. Burr, Ph.D., and Everett R. Wolford, of the Western Utilization Research Branch of

the Agricultural Research Service, United States Department of Agriculture.

At least some segments of the population will benefit nutritionally, they said, in reviewing the trend toward developing more and improved convenience foods. The wider the variety of foods available in easy-to-prepare form, the more varied will be the diet of the family dependent

bution of rural physicians is emphasized by the findings of a study in the 32 counties of western New York comprising the Buffalo, Syracuse, and Rochester regions, Terris and Monk said.

### Trends in population-physician composition of the population of the United States

Year	Rural population (percent)	Rural physicians (percent)
1906-----	53	41
1929-----	48	31
1940-----	43.5	20

That rural areas tend to lose physicians in periods of prosperity and to keep them in periods of depression is apparently one of the laws governing the distribution of physicians in the United States, Terris and Monk continued. According to Mountin and Pennell, between 1923 and 1931, a period of prosperity, the rural population of the United States increased 5 percent, whereas the number of physicians in these areas decreased more than 17 percent, they said. The figures for 1931-37, a period of depression, were 6 and 2 percent, respectively.

### Age Distribution

In upstate New York in 1930, the

age distribution of physicians was essentially the same in all communities, regardless of size; in 1930, physicians in rural areas were considerably older than physicians in urban areas, Terris and Monk stated. This finding is in sharp contrast to the findings of other studies, they pointed out. It may be accounted for by the influx of new graduates into rural areas during the depression years; by the number of young physicians, many of them local residents, graduating each year from the three medical schools in the region studied; and by the fact that the favorable economic position of upstate New York enables rural areas to attract and hold young and middle-aged physicians, they said.

### Specialization

Terris and Monk were of the opinion that "despite certain evils of specialization . . . we believe the growth of specialization has been a most important factor in improving the quality of medical care." Some of the differential in the quality of available medical resources between the large cities and the smaller centers is diminishing. In only 10 years, the percentage of full-time specialists in all areas of the three regions as a whole has increased over 50 percent, from 22.3 percent in 1940 to 36.8 percent in 1950. In rural areas, the percentage of specialists

rose from 2.5 percent to 6.4 percent, although, in comparison with the urban communities, the percentage of full specialists remained quite low. Sooner or later, the emphasis of postgraduate education will have to take cognizance of these changes.

### Income

In the three large cities in the study area, the physician-population ratio increased for the city as a whole and for the middle-income and high-income neighborhoods. For the low-income neighborhoods, however, there was a decrease. From 1930 to 1950, the decrease was 7 percent in Rochester, 14 percent in Syracuse, and 24 percent in Buffalo.

"The widening gap in physician-population ratios between low-income and high-income areas of large cities is apparently a recent phenomenon, at least in the three cities studied," Terris and Monk stated. No ready explanation is available, they said, although the war may have been a factor from 1940 to 1950, when physicians found it easy to change locations.

"It would be of considerable interest to study the situation in other large cities in order to learn whether the decline in the number of physicians in low-income neighborhoods is a general phenomenon and to determine the periods in which such declines occurred," they concluded.

Percentage of physicians in the Buffalo, Rochester, and Syracuse regions in 1930, 1940, and 1950, according to number of years after graduation

Size of community	Years since graduation								
	1930			1940			1950		
	0-10	11-30	31 and over	0-10	11-30	31 and over	0-10	11-30	31 and over
Under 2,000-----	19.1	32.0	48.8	31.3	27.8	40.9	14.7	55.3	29.9
2,500-9,999-----	15.5	37.3	47.2	29.2	33.7	37.1	15.0	52.9	32.1
10,000-49,999-----	23.1	42.3	34.6	24.6	44.1	31.3	14.2	57.5	28.4
50,000-99,999-----	25.6	44.6	29.7	25.1	50.2	24.7	15.3	59.9	24.7
100,000 and over-----	27.0	48.6	24.4	24.8	46.7	28.5	21.2	51.1	27.7
Total-----	23.9	43.5	32.6	26.2	42.2	31.6	18.2	53.5	28.3

The first test showed that both research and control groups fell below the standard recommended for daily intake of milk, eggs, citrus fruits, other fruits, butter and fortified margarine, Irish and sweet potatoes, green leafy vegetables, non-leafy vegetables, whole grain and enriched products, and lean meats. The highest intake was in meat—one class consumed 46 percent more than the recommended daily dietary allowance. The lowest intake was not only in green vegetables but in butter and fortified margarine, milk, and potatoes as well.

Some of the teachers planned study trips to city markets, followed by vegetable-tasting parties to get at the problem of changing the diet pattern. The next year the problem was approached through an animal-feeding demonstration with guinea pigs. Another way of meeting it was to plan meals from menus of different places.

When one teacher learned that few of her students had ever been to a restaurant, she decided that actual experience with money and transportation, good manners and good grooming, and knowing why certain foods were chosen were essential to help boys and girls hurdle the transition from 25-cent plate lunches to the selection of meals in high school cafeterias and public eating places.

From this and similar experiences, two filmstrips were later prepared. One is entitled "Eating Out."

#### *Measured Gains*

At the beginning of the study only 53 percent of the research group and 35 percent of the control group met the recommended dietary allowance in green leafy vegetables. At the end of the second year there was only a 19-percent gain for the research group and a 13-percent gain for the control group.

At the close of the second year the children who participated had met or surpassed the recommended daily allowance in 6 food groups. The control group met or surpassed the standard in 2 food classes only.

At the end of the study the research groups had met or surpassed the food standards in 3 food groups and had made gains in 7. The greatest gain, 21 percent, was in butter and margarine intake. The control groups met or surpassed the recommended allowances in 1 food group and made gains in 3 food groups, including the fats.

Over the 3 years, the sixth graders showed an improvement in food intake in every group except non-citrus fruits and nonleafy vegetables. The sixth grade controls improved their food intake only in meat, fats, and potatoes.

Results of the Ohio education and hygiene test showed the groups in the research schools to have a broader and more scientific knowledge of food than those in the control schools.

The nutrition information test showed an equality in medians between the research and control groups at the start, 43 for both, but 3 years later the medians were higher—61 for the research group and 53 for the control group.

The above average scores on reading, language, and social studies for the research group allayed all fears teachers had expressed about the amount of time they spent on nutrition education.

### **Chronic Malnutrition Pictured in Mexico**

Evidence gathered from malnourished patients at the Hospital de Enfermedades de la Nutrición, Mexico City, Mexico, D. F., suggests that inadequate nutrition leads to lowered cellular activity: Cells are unable to use the indispensable vitamins and hormones which promote cellular metabolic activity with the result that glands, lacking normal stimuli, atrophy.

The director of the hospital, Salvador Zubirán, M. D., said that the hypothesis of decreased activity in the entire endocrine systems is supported by clinical, histological,

endocrine, and dietetic studies on 543 patients between ages 20 and 60. Recovery of patients placed on an adequate dietary regimen and concurrent work with children at the Hospital Infantil de Mexico also support the theory, even though experimental evidence is still needed, he added.

The nutrition studies have led to the concept of a chronic deficit in every component in the diet. The Mexican investigators have termed the multiple deficiency "chronic malnutrition" to denominate the complex clinical manifestations found in the malnourished patient suffering from a combination of pellagra, pellagra sine pellagra (when there are no dermatological manifestations), beriberi, hypoproteinemia, nutritional anemia, and ariboflavinosis.

"We know now that the endocrine disturbances have great significance and should always be investigated in malnutrition because they have at least the same importance as the alterations in other organic functions and are more important and more significant for the life and well-being of . . . patients than the dermatological alterations so fully described by others," he stated.

He explained that although nutritional deficiency is common to Mexico and the rest of the Latin American countries, the people show no signs of deficiency in clinical examinations or in laboratory tests. They are apparently healthy and capable of much physical exertion. Insufficient intake is manifest only in a decrease in mental capacity, lack of ambition, short stature, and in low resistance to infection. Otherwise, their bodies are adapted to a diet inadequate in calories, vitamins, and proteins especially. Any slight reduction in the usual intake or any increase in metabolic requirements, however, easily upsets their equilibrium.

#### *Chain Reaction*

A diet deficient in every respect affects each cell in the organism and the organic functions, leading to

on the employed housewife to prepare the meals. Improved color, flavor, and stability, the goals of the processing industry, are usually accompanied by improvements in handling, processing, and storage procedures which largely preserve the nutritive values of the fresh commodity, they stated.

They also felt that the cost of these foods to the groceryman and the consumer would decline as volume expands and competition thrives.

Already observed is the trend to variety in household menus. They pointed out that housewives can now obtain pre-prepared Italian, French, kosher, Chinese, or Mexican dishes although they would have great difficulty in obtaining from grocery shelves the ingredients to prepare these dishes themselves.

Much research in convenience foods is conducted by the Agricultural Research Service, particularly in those foods vital to the armed services.

Burr and Wolford said they expected that in the near future the housewife will be able to buy satisfactory dehydrated foods, like onion flakes, from her grocer. These are now being used successfully by manufacturers of soups, stews, and casserole dishes. Dried eggs and egg fractions and dehydrated diced potatoes satisfactory to the consumer also are to be expected.

### *New Products*

Food processors are beginning to apply vacuum puff-drying techniques to fruit and vegetable juices and may possibly adapt them to milk and other liquid or pureed foods, they stated. Among the most promising today are:

A stable instant orange juice powder with a storage life in excess of 6 months at 100° F. with very little change in flavor or vitamin C content and only minor losses of carotene. Other citrus fruits will be processed similarly.

A tomato juice powder which can be reconstituted into an excellent juice or can be used as a substitute for tomato paste for use in the preparation of dry mixes for tomato

aspic, spaghetti sauce, or tomato soup. Losses of ascorbic acid during storage of the tomato powder are negligible when packaged in vacuum or under nitrogen with an inpackage desiccant, not more than a few percent loss in 6 months at 100° F. In contrast, under the same conditions canned tomato juice may lose 40 percent of its ascorbic acid, and a high solids canned tomato juice concentrate may lose 80 to 90 percent.

### *Dried and Concentrated Foods*

Mashed potato powder appeared on the retail market in 1947. At that time it met with limited consumer acceptance, they reported, as it developed a brownish offcolor and a slightly scorched flavor during storage. The product has been improved until it is virtually free of this defect. A second defect, a pasty or rubbery texture in the reconstituted potatoes, they stated, will not appear if directions are followed carefully.

Dehydrated milk products have been improved and are finding consumer acceptance, they reported.

A new technique using the enzyme glucose oxidase which converts the glucose in whole egg and yolk into gluconic acid has eliminated the objectionable browning of dried egg products and greatly increased their storage stability from a flavor standpoint, they disclosed. They said that the dried whole egg solids produced by the new process are about 50 times as stable as the World War II product, and if properly packaged the new product should make highly acceptable scrambled eggs even after a year in storage at 100° F. At the same time, extensive research in pasteurization has resulted in general acceptance of methods to reduce active microbial contamination of egg solids.

### **Nutrition Education Alters Students' Menu Patterns**

In Kansas City, a natural locale for steaks and beef roasts, nutrition experts suspect that green leafy vege-

tables are seldom part of the family meal.

At least, the food habits of young teenagers indicate that the family pattern of eating may emphasize meat to the neglect of green vegetables. Some food habits, however, have been favorably influenced by the emphasis given to nutrition education in the public schools. Other values of the program may not be evident until these children have grown up and have homes of their own.

Patricia Ruth O'Keefe, Ph.D., director of health and physical education for Kansas City schools, told about a recently completed study undertaken to measure what boys and girls know, as well as what they do, about nutrition. She said that the statistical data will be found in a subsequent report.

Patterned on the nutrition studies made in Ascension Parish, La., by Dr. Eugenia Whitehead, University of Iowa, the study centered around the individual teacher's creative ability to relate nutrition education in her classroom to other subjects and to community activities. The experiences planned for the children were as limitless as the initiative and interest of the teacher. Materials and help were given, and parents, principals, and educators were consulted for exchange of ideas and information. Dr. Whitehead was co-director of the study.

### *Creative Education*

Sixth and seventh grade children in 2 schools were tested along with the same grades in 3 other schools, but the children in the first 2 schools were not aware they were functioning as a control group. Both control and research groups were followed for 3 years and tested at intervals. When they reached the eighth grade, research groups showed evidence of holding their own and making better nutritional progress than the control groups.

All six participating teachers developed their own programs after the first food appraisal revealed the areas needing improvement.

males (the final count was 280 males and 297 females); age distribution as comparable as possible to the general community.

The investigation included a 7-day recorded food intake and general food history taken by a nutritionist; clinical history including general medical and detailed systems history; a physical examination; and laboratory procedures including: blood hemoglobin, serum protein, sedimentation rate, packed red cell volume, blood glucose, ascorbic acid, vitamin A, carotene, non-protein nitrogen, free cholesterol, and cholesterol total, leukocyte count with cell differential, erythrocyte count, and serologic test for syphilis.

Also included, they added, were urine glucose and albumin tests, chest X-ray, bone density determination, and vaginal Papanicolaou smears for all female patients.

This report, Chope and Breslow said, is only one phase of this broad study. It provides an approach to the part which preventive medicine may play not only in the prevention of deaths from heart disease, neoplasms, and central nervous system disease, but also in promoting a fuller life for the aging.

### Claims Food Advertising Has Adequate Policing

Refutation of the contention that food and nutrition advertising is inadequately controlled was offered by Paul J. Cardinal, B.S., vice president in charge of the vitamin division, Hoffmann-La Roche, Nutley, N. J.

The Federal Trade Commission and the Food and Drug Administration, he believes, are effective deterrents to serious abuses of public credulity. The advertiser, he added, may also have to remember other Federal agencies, such as the Treasury Department if he is selling an alcoholic beverage. He is mindful also of State laws and of organizations such as the better business bureaus.

These, along with an increasingly well-educated public, remove the need for additional voluntary tribunals, he stated.

Cardinal pointed out that in the \$8 billion advertising business, most advertisements are developed by experts who, through survey and test campaigns, keep alert to the public attitude. Nutrition workers will get results from justifiable criticism by writing direct to advertisers, he maintained.

Life is far from light for the person who has final responsibility for the claims to be made in his com-

pany's advertising, he said, and declared that the desire to be correct, accurate in scientific data, and fair is predominant. A cease and desist order, he explained, is a blight upon the company's record and as worrisome as the arrest of one's child.

The American public likes advertising, he claimed, recognizes it has contributed to high standards of living and comfort, and knows that high-pressure selling may produce some overemphasis. The public, he said, feels itself qualified to judge good from bad claims and insists it be left free to do so.

## Health Services for Migrants . . .

### Migrants in Colorado Get Health Services

Planning for health services for migrant agricultural workers means planning for adequate services for all residents of a community and making these services available to migrants, stated Ruth B. Howard, M.D., M.P.H., and Georgia B. Perkins, M.D., of Denver, Colo.

Dr. Howard is chief of the maternal and child health and crippled children section, Colorado State Department of Public Health, and Dr. Perkins is regional medical director, Children's Bureau, Region VIII, Department of Health, Education, and Welfare.

Health services are "available" only if they are acceptable to and meet the needs of a group, they continued. In many areas, coordination of existing services is all that is necessary to accomplish this; in other communities, new public or private services may need to be added or other services expanded during peak seasons.

Health and welfare services, they stated, must be adapted to the cultural characteristics of the migrating group and of the local com-

munity. The medical problems of migrants, although aggravated by the circumstances of their lives, are similar to the medical problems of permanent residents of a community. Migrant workers will accept health services when these services are offered in terms which they can understand, they asserted.

Also, in all places where the migrant travels or lives, health and welfare services must be coordinated. Even in local areas, groups such as the county welfare department, employers' groups, voluntary agencies, the health department, and the medical society frequently are not familiar with the resources and programs of the others. However, progress is being made toward better understanding between these groups.

### Colorado Project

Howard and Perkins described a project in two large labor camps—Fort Lupton and Palisade—in Colorado for improving the quality and availability of maternal and child health and other medical services for agricultural migrants. In this project, particular consideration was given to improving communication between the migrants and local resi-



clinical syndromes in one or another system of the body, Zubirán continued. Lesions of the skin and mucous membranes are present and so are neurological, hematological, digestive, and endocrine disturbances.

When the nutritive elements are not present in amounts adequate for normal cellular life, organic combustion decreases within the cell. All of the cellular metabolic processes decrease progressively until only those absolutely necessary for life remain.

The metabolic processes are slowed, and the rate of utilization and inactivation of hormones deriving from the target glands is proportionately diminished. This decreased utilization results in a relatively high blood concentration of the hormones, leading to inhibition of the pituitary gland. Thus, the production of trophic hormones is reduced, and the target glands do not receive their customary stimuli.

The final result is a picture of panhypopituitarism resulting from the reduced amount of hormones secreted by the target glands and from the incapacity of the tissues to respond to the hormones.

Panhypopituitarism in turn leads to a dysfunction of the entire endocrine system. The gonadal functions are the first to be lost. Next, in a minor degree the functions of the adrenals and thyroid are altered. Toward the end, the endocrine functions that intervene in vital oxidation and production of energy are lost.

Histological studies of post-mortem and biopsy material obtained in 195 cases of malnutrition constantly showed atrophy and involuntary changes in the anterior pituitary, adrenal, and thyroid glands, and in testes or ovaries. Hormone determinations and endocrine function tests as well as the clinical studies showed the existence of marked hypogonadism, amenorrhea, and low estrogen activity in women, and, in men, impotency, decreased libido, and marked testicular atrophy.

## Dietary Study on the Aged Shows Need for Research

A controlled, detailed, longitudinal study between 1948 and 1954 on the nutritional status of 577 aging persons in San Mateo County, Calif., revealed that dietary factors show a high correlation with some diseases.

The study, based on analysis of food intake and blood chemistry, was reported by Harold Chope, M.D., Dr.P.H., director, San Mateo County Department of Public Health and Welfare, and Lester Breslow, M.D., M.P.H., chief, bureau of chronic diseases, California State Department of Public Health, San Francisco.

Of 88 deaths—63 male and 25 female—occurring among the 577 subjects, 85 percent resulted from 3 causes: heart and circulatory diseases, nervous system diseases, and malignant neoplasms, they reported.

Although this series is small, it confirms other previous study findings. These are:

Heart and circulatory disease is the greatest killer of all the diseases.

The death rate from heart and circulatory diseases is 5 times greater in those over 70 than in those 50 to 69 years of age.

The death rate from nervous system diseases is about equal in men and women, but  $2\frac{1}{2}$  times greater in those over 70 than in those 50 to 69.

To date the death rate from malignant neoplasms among the subjects studied is 3 times higher in males than in females, but about equal for the two age groups.

The death rate from disease of the respiratory system is 3 times higher in males than in females and 7 times higher in those over 70 than in those 50 to 69 years of age.

### Dietary Relationships to Deaths

The percentage of deaths in patients with recorded systolic pressures of 180 mm. of mercury and more was 4 times higher than for those whose systolic pressure was under 140, they said. In males the percentage of deaths was  $4\frac{1}{2}$  times

greater and in women only  $1\frac{1}{2}$  times greater than in those with systolic pressures under 140. Diastolic pressures did not correlate to the same degree, although the death rates were slightly higher when pressure was 100 than it was when under 90.

Overweight persons were shown to have a death rate from cardiovascular-renal disease nearly double that of normal weight individuals, they said. A relationship between high cholesterol and hypertension or cardiovascular-renal deaths could not be supported by the data. Subjects with lower blood cholesterol suffered the highest death rates from these diseases, they reported.

The death rates in persons with low blood concentrations of vitamin A, niacin, and ascorbic acid was higher than in those with normal or high concentration, they said.

No significant relationship could be found between death and hemoglobin, blood glucose, blood creatinine, caloric intake, protein intake, fat intake, carbohydrate intake, calcium or iron intake, they declared.

The maintenance of a sufficient ascorbic acid intake is apparently essential for good oral hygiene to preserve teeth and prevent gingivitis, they asserted. Study subjects with ascorbic serum less than 50 mg. were 50 percent endentulous; those with 50–109 mg. were 40 percent endentulous, and those with 110 mg. were only 32.3 percent endentulous.

The Bureau of Human Nutrition and Home Economics, United States Department of Agriculture, the Public Health Service, the University of California department of home economics, the California State Department of Health, the San Mateo County Department of Public Health and Welfare, and the San Mateo County Medical Society participated in the study.

Criteria for selection of the subjects were: not on a special diet; not under the care of a physician within the past 3 months; physically and mentally capable of participating, and subjectively in good health; an equal sample of males and fe-



On the committee were representatives from the Oregon State Medical Society, State Department of Education, State Board of Health, Tuberculosis and Health Association, Cancer Society, Mental Health Association. Medical schools, the State university and college, teacher and private colleges and universities also were represented.

The policy committee developed a report on functions and competencies to serve as the basis for curriculum construction, Anderson reported. A central committee of 17, representing school administrators and teachers, developed the curriculums, as amended later by the policy committee. These were designed for preparing secondary and elementary school teachers in health.

The contents for the curriculums of colleges, secondary and primary schools were developed by 56 educators. In a 2-week workshop held at Oregon State College, the educators were assigned to subject matter committees of their own choosing. Their recommendations, edited by a subcommittee, were placed into a composite report and approved with modifications by the central and policy committees.

The final product, Anderson stated, provides the basis for certification for health teaching and also serves as guide to the schools in States preparing teachers for health instruction.

Anderson felt that the development of the standards was made possible through use of "a thoroughly democratic process" in which the persons interested in school health united their efforts.

During the general sessions of the workshop, Anderson said, the participants became acutely impressed with the need for a further understanding of school health on the part of school administrators if school health programs were to be effective. The workshop participants passed a resolution urging the State department of education to incorporate school health in the professional preparation of administrators. The

proposal was accepted and a unit was incorporated into an existing course in school administration.

## Preplanning Techniques Key to Success

"More than any other educational procedure, the health education workshop provides the opportunity for the participant to assume responsibility for his own learning in an environment in which tensions are reduced, where there is emphasis on individual growth, where there is time for planning, study, observation, and recreation, and where each individual's ideas and contributions are valued."

This statement by Edward B. Johns, Ed.D., professor, school health education, University of California at Los Angeles, summed up his review of the techniques in health education workshops.

Preplanning is a prerequisite technique for producing an effective workshop, he indicated. Preplanning sessions achieve team cohesiveness, determine the need for a workshop, identify the current problems of the group, decide the central theme, he said.

Johns favored the type of preplanning in which the group develops the framework for the program, including the general sessions, with a time schedule for individual conferences and group meetings. This includes handing out such information in booklet form for distribution to the participants. It also provides for the election by participants of a program-of-work committee, giving members the opportunity to share in planning their own program.

Factors to be worked out in this stage, he said, include the following: the amount of financial support; the selection of an outstanding staff, consultants, and resource persons; the production of a brochure and agreement on the amount and type of publicity; and the size of the workshop group.

The mark of real achievement by

the preplanning group is the ability to mix the proper ingredients of program structure to give the workshop form and substance and at the same time allow for flexibility with opportunities for program planning on the part of the participants, he continued.

Mindful that some workshops have been unsuccessful because of the failure of those concerned to determine the demands of prospective members in the field, he remarked, "A workshop is not a workshop if it is a series of sessions forced upon a professional group."

One of the best means of assuring financial support is to encourage participation of the influential representatives of organizations and agencies in the preplanning sessions, he said. Other effective techniques he recommended are the following:

For the proper orientation of leaders, distribute mimeographed materials on the role of the consultant, the resource person, the chairman, and the records, plus a thumbnail sketch of each leader's function.

For evaluation of workshop results, have staff members discuss each participant's accomplishments in a staff and consultants' meeting to make sure that the progress achieved was accurately and fairly appraised.

For securing as many administrator-participants as desired, capitalize on the general interest of the administrator in healthier, happier children, youth and adults, or pay his expenses, or lure him to an outdoor workshop held in an exceptionally fine recreation area.

## Pennsylvania's Workshops Show Positive Results

The workshop, a comparatively recent venture in the field of health education, among other results is proving an effective means of community-school cooperation, concluded Arthur L. Harnett, Jr., Ed.D., in charge of health education, Pennsylvania State University, in

dents, the agencies and individuals, the local communities within the State, and the States where the migrants traveled.

In each community, it was emphasized that each part of any program would be undertaken only if it was mutually agreeable to the community and the project administration.

The programs in the two camps were similar, although some policies differed. For example, in Fort Lupton, home visiting by nurses was not euphasized; in Palisade, nurses routinely called on all new families.

A medical social worker assisted in community organization and project planning and promoted inter-agency cooperation by keeping local, State, and Federal agencies informed about the project. She also gave technical consultation to the staff of both camps and direct advice to some patients, and she participated in the home followup of some of the 28 pupils in a 6-week school for children of migrants.

Problems of chronic disease and disability, among them cases of tuberculosis, were found in both camps. Although the tuberculosis patients could not meet the residence requirements for hospitalization at State expense, a voluntary institution accepted them without charge. Hospitalization of the patient often depended upon making satisfactory provision for the other members of the family, particularly the children, Howard and Perkins said.

They reported that, in both camps, the clinical conditions most frequently seen were diarrhea and upper respiratory infections. There were 35 known pregnancies in Fort Lupton, 23 in Palisade; 1 infant death and 1 delivery in Fort Lupton, none in Palisade. A puzzling finding was the incidence of burns, high in Palisade and low in Fort Lupton. Clinic services were used at some time by 22 percent of the individuals at Fort Lupton and by 17 percent of those at Palisade, they said. A summary of the use of health services in the two camps is shown in the tabulation.

#### In camp:

Families.....	425	328
Individuals.....	2,213	1,316
Adults.....	1,190	832
Children.....	1,023	484

#### Seen in clinic:

Families.....	198	135
Individuals.....	496	224
Adults.....	226	88
Children.....	270	136

#### Individuals seen by:

Physician.....	319	72
Nurse alone.....	181	224

#### Total visits:

Clinic.....	1,056	385
Home (public health nurse).....	73	633

Fort  
Lupton    Palisade

Although the experience in these two camps does not furnish an accurate picture of the medical needs of migrant agricultural workers, it can serve as a basis of comparison with future results and with the experience of other medical care projects.

#### Project to Continue

At the end of the season, Howard and Perkins reported, the consensus was that the project had been definitely successful and that health needs had been taken care of earlier and more smoothly than in past years. Improvement in relationships and communications between agencies was noted as each agency learned about the other's functions and resources. The work of the nursing staff with representatives of

the peach growers and in the community had resulted in better understanding of the local health department.

The program is to be repeated next year, they said. In the meantime, efforts are being made to improve communications within the communities and to overhaul and improve record forms, in consultation with interested groups, with particular emphasis on means of referral between health services. "We... will continue to advocate the formation of a State committee for Colorado," they concluded. "With such a committee and with the State structure properly integrated with that of the region, we believe that health services in local areas can be so developed and fitted together that migrants like other citizens can receive the care they need."

## Health Education Workshop . . .

### Health Training Standards Set by Oregon Workshop

Standards for teacher preparation in school health work have been established in Oregon following extensive study by professional groups.

C. L. Anderson, Dr.P.H., professor of hygiene and health education,

Oregon State College, Corvallis, reported that a professional policy committee of 17 members was formed to suggest and establish standards after the Oregon State Department of Education reported 3 years ago that the State's school health program was handicapped by teachers inadequately prepared in health.

rated on school health by the State department of education.

## *Accomplishments of the Program*

Reviewing the accomplishments of the school health program since 1947, Farris stated that Arkansas now has part-time health coordinators in most public schools; five publications dealing with school health have been supplied to schools without charge; a section for school health coordination has been established in the program of the Arkansas Education Association; and additional personnel have been employed or personnel have been reas-

signed in the State department of health and education.

The program has pointed the way for other interested groups to improve their areas of education, Farris said in conclusion, and "we are seeing a new awakening on the part of the local school administrators." The State school superintendents and the county school administrators have formally endorsed the efforts which have been made to improve the health of school children, and both State and county schools now have an advisory committee which quite actively assists the joint coordinating committee in many facets of its program.

the Benelux countries, and over the channel into England. He has to weigh the necessity for strict quarantine of hunting dogs which, if they are shipped to the United States, could carry infected fleas from the European rabbit to the American rabbit.

The military veterinarian indirectly bolsters the economy of the host nation as he tries to solve the problem of supplying meat and milk, Juni said. He has a record of establishing new food processing industries, improving existing distribution channels, and modifying inspection methods to meet the strange new threats to health. His military food sources are cited as models by related industries in the country.

Difficulties encountered in establishing a new source of milk supply in France, for example, illustrate the necessity for compromise with the local scheme of living. A vast amount of farm sanitation had to be done at the start, making it necessary to use a separate processing operation for milk from farms meeting minimum standards. Tuberculin testing and quality control of raw milk were instituted to enable other farms to qualify for the segregated farm supply.

These obstacles were superseded by the problems of locating a water supply uncontaminated by sewage, adapting local methods of counting bacteria to American specifications, and getting the release of health certificates on dairy workers when local custom decreed that they be seen only by a licensed physician.

## *Tuberculosis*

Potential hospitalization of infected personnel with a long-term disease such as tuberculosis means a loss to the command, Juni continued.

Tuberculosis is common in dairy cattle in Europe. Generalized infections are routinely found in local abattoirs. In some areas cattle herds are 90 percent infected, raising the question of bovine sources for extrapulmonary cases in humans. Pulmonary infections of bovine origin have been reported also in areas

# Military Public Health . . .

## Overseas Tasks Challenge To Military Veterinarian

Reviewing veterinary public health problems encountered at overseas military bases, Maj. Robert P. Juni, V.M.D., M.P.H., said that the military veterinarian's responsibilities range beyond food inspection activities into preventive medicine.

Formerly veterinarian with the 4th Epidemiological Flight attached to Surgeon, USAF in Europe, Major Juni is now command veterinarian, Air Proving Ground, the Eglin Air Force Base, Fla. He said that military public health in Europe embraces military families in a dozen different countries.

He ascribed the expansion of veterinary medicine overseas partly to the shortage of base-assigned physicians and sanitary engineers, and partly to the increased emphasis on the study of how diseases were actually being spread. Much of the expansion he attributed to the practical necessity for organizing workable systems.

Local foodstuffs supplied to overseas bases are entirely under the military veterinary inspection system. Procurement is complicated by local production methods, processing machinery, difficulties with languages, customs, and laws.

## *Military Public Health*

The staff veterinarian, in peacetime Europe, improvises practical measures and initiates his public health reforms with limited personnel and limited facilities. In these circumstances, Juni said, he quickly becomes a student of the natural history of the local infective agents as well as an amateur anthropologist. Even some of the infections prevalent in the United States may have a different clinical course locally. The veterinarian steps into the role of liaison officer in his efforts to cooperate with the agricultural animal disease programs in each country.

To prevent transmission of exotic animal diseases across the Atlantic, he may find himself following the host country's epidemiological reports on myxomatosis, the well-publicized rabbit plague which spread from France into Germany,

his discussion of the 10 years of experience with workshops in Pennsylvania.

He cited the following as other results of workshop projects: They provide a method of unifying and strengthening the efforts of individuals, which otherwise might be ineffective; they give many specialists—in medicine, dentistry, nutrition, psychology, public health, and education—a chance to share in planning programs in health education; and they are a means of discovering current trends and problems in health education.

Harnett said the workshop is characterized by a program based on interests, problems, and needs of experienced health teachers or leaders; democratic procedures; ease of communication; and a variety of methods for individual and small group participation. Its social climate sheds a "halo effect" upon all the work undertaken.

Harnett reported that in Pennsylvania each of the 6 annual workshops is planned by each workshop director with the help of a central statewide committee—the Inter-Agency Planning Committee. The latter group is comprised of representatives from State departments of health, welfare, and public instructions, the State medical society, and the Pennsylvania Tuberculosis and Health Society.

Participants are selected locally, Harnett said, with guidance from the county superintendent of schools. Scholarships from local voluntary health agencies—cancer societies, heart associations, tuberculosis societies, and chapters of the National Foundation for Infantile Paralysis—are awarded to participants.

The participants later have a chance to evaluate the workshop through their own efforts. Harnett listed six evaluation procedures by which the effectiveness of the program can be judged.

1. A comparison of preworkshop questions and problems with end-of-workshop findings as to how these same questions and problems were answered.

2. A measure of health information, both factual and applied, gained by each participant during the 3-week workshop, as shown by standardized tests.

3. Evaluative statements, checks, and opinions of participants on the conduct and outcome of the workshop, particularly in relation to the effectiveness of group interaction.

4. The judgment of a representative steering committee, which meets regularly and interprets the opinions of the workshop members, conditioned by an evaluation of present program and immediate needs.

5. Periodic summaries during the workshop, such as end-of-the-week reviews, to determine changes, emphasis, and direction of the workshop program.

6. A followup questionnaire, some 8 months to a year after the workshop, to discover progress in attaining more remote or long-term objectives. Some workshops have had reunions or evaluation meetings to discuss strengths, weaknesses, and values in the workshop program.

## Cooperation Features Arkansas Planning

The health of the child is of first importance in Arkansas schools, asserted Jeff Farris, M.S., director of health and physical education, Arkansas State Teachers College, Conway, and consultant in school health, Arkansas State Board of Health, Little Rock.

Farris reported that progress during recent years in developing and improving Arkansas school health programs was due to cooperative planning among State agencies.

The guiding principle of cooperative planning was to include almost every State group which had a contribution to make in planning the school health program, Farris stated. The State department of education and the State board of health have been the leaders, but the Parent-Teacher Association, the Arkansas Education Association, the Univer-

sity of Arkansas Medical Center, the crippled children's division of the State department of public welfare, the Lions Club and other civic groups, the county health departments, and most State and voluntary agencies have participated in planning and operating school health activities, he said.

Cooperative planning in Arkansas had its beginning in 1947 at the Southern States Work Conference in Daytona Beach, Fla., Farris said. While attending the conference, representatives from Arkansas decided to establish pilot programs of school health in three of the school health systems. In the summer of 1948, a workshop included a group of school superintendents who wanted their schools to be part of the pilot group. A 2-week workshop has been held every summer since then for representatives of all agencies taking part in the program. About 1,000 persons have attended these workshops, he reported.

## Coordinating Activities

Perhaps the most important single administrative result of the workshops has been the Joint Coordinating Committee for Promoting Health Education in Schools, Farris said. This is a permanent group made up of an equal number of members from the State departments of health and education and is the coordinating and activating agency for all groups participating in the school health program. The chairman and the secretary are chosen from one department one year and from the other department the next. Subcommittees are responsible for the various areas of school health.

Arkansas has no special school health agencies, Farris stated, and financial, educational, professional, and civic agencies work together. One agency supplies money and others supply personnel, transportation, or materials.

The State board of education has adopted standards for school health produced at the 1951 summer workshop, Farris said. Schools are now

# Milk Sanitation Honor Roll for 1954-55

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Communities on the honor roll have complied substantially with the various items of sanitation contained in the Milk Ordinance and Code Recommended by the United States Public Health Service. The State milk sanitation authorities concerned report this compliance to the Public Health Service. The rating of 90 percent or more, which is necessary for inclusion on the list, is computed from the weighted average of the percentages of compliance. Separate lists are compiled for communities in which all market milk sold is pasteurized, and for those in which both raw milk and pasteurized milk is sold.

The recommended milk ordinance, on which the milk sanitation ratings

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are based, is now in effect through voluntary adoption in 422 counties and 1,600 municipalities. The ordinance also serves as the basis for the regulations of 34 States and 2 Territories. In 11 States and the 2 Territories it is in effect statewide.

The ratings do not represent a complete measure of safety, but they do indicate how closely a community's milk supply conforms with the standards for grade A milk as stated

in the recommended ordinance. High-grade pasteurized milk is safer than high-grade raw milk because of the added protection of pasteurization. The second list, therefore, shows the percentage of pasteurized milk sold in a community which also permits the sale of raw milk.

Although semiannual publication of the list is intended to encourage communities operating under the recommended ordinance to attain and maintain a high level of enforcement of its provisions, no comparison is intended with communities operating under other milk ordinances. Some communities might be deserving of inclusion, but they cannot be listed because no arrangements have been made for determination of their ratings by the State milk sanitation authority concerned. In other cases, the ratings which were submitted have lapsed because they were more than 2 years old. Still other communities, some of which may have high-grade milk supplies, have indicated no desire for rating or inclusion on this list.

## Communities awarded milk sanitation ratings of 90 percent or more, 1954-55

### 100 PERCENT OF MARKET MILK PASTEURIZED

Community	Date of rating	Community	Date of rating	Community	Date of rating
<i>Arizona</i>		<i>District of Columbia</i>		<i>Georgia—Continued</i>	
Phoenix.....	11-21-1955	Washington.....	3-15-1954	Camilla.....	9- 9-1955
<i>Arkansas</i>		<i>Florida</i>		Columbus.....	2-17-1955
Fort Smith.....	8-26-1954	Jacksonville.....	8-27-1954	Dalton, Whitfield	
<i>Colorado</i>		<i>Georgia</i>		County.....	9- 9-1955
Boulder County.....	2-25-1955	Albany.....	12-16-1954	Dublin.....	3-18-1955
Colorado Springs.....	1-20-1954	Athens-Clarke County..	4- 8-1955	Eiberton.....	2- 9-1954
Denver.....	10-28-1955	Atlanta.....	10-28-1955	La Grange.....	7-15-1954
Grand Junction and		Augusta-Richmond		Moultrie.....	11- 4-1955
Mesa County.....	4-15-1954	County.....	7- 2-1955	Quitman.....	8-25-1955
Las Animas-Huerfano		Cairo.....	2-25-1955	Savannah, Chatham	
Counties.....	3- 9-1954	Calhoun.....	7-28-1955	County.....	8-12-1954

of high incidence in cattle. Germany reports the incidence of tuberculosis as being 21.95 per 10,000 persons in 1953, with surveys indicating that 10 percent of these cases are of bovine origin.

Denmark and the Netherlands already have eradication plans in effect. England is in the process of establishing additional accredited areas. Germany and France have the nucleus of area plans in regions in which the quartermaster corps has sponsored a milkshed.

However, tuberculosis control has been hampered by incomplete epidemiology of the disease among military personnel. Fortunately, the natural fastidiousness of the typical American plus local controls over large off-base restaurants and military inspection of local food supplies decreased the risk of infection for troops.

### Other Diseases

Pets owned by military personnel have, at times, been responsible for many veterinary control problems, Juni indicated.

To control outbreaks of psittacosis, registration of parakeets and other psittacine birds is required.

Routine immunizations of household pets quickly eliminated the threat of rabies when it became known that wildlife rabies was prevalent in West Germany for the first time since the Napoleonic wars.

In Rheinland-Pfalz, when 50 percent of 179 herds of sheep tested positive for brucellosis (Malta fever), possible spread to the families of military personnel was avoided by arranging to have local veterinary police ordinances rigidly enforced before sheep were allowed to graze on military bases.

Immediate control measures were initiated when it was found that 40 percent of Air Force guard dogs in Europe and North Africa had a significant titer for leptospirosis.

The bases in the areas where leptospirosis of any type was endemic were advised of the hazard of epidemics. The protean nature of the clinical symptoms was stressed, and

arrangements were made for the submission of serum samples for definitive diagnosis. The factors affecting the size of the wildlife reservoir were watched so that epizootics and consequent epidemics could be anticipated.

The ecology of other zoonoses was studied in an attempt to evaluate other potential health hazards. One objective was the avoidance of possible breakthrough of any animal diseases. A second objective in such studies was the provision of readily accessible information upon which to base control measures in the event of outbreak, Juni concluded.

### Describes Public Health In Military Government

American military experience with Civil Affairs and Military Government (CAMG) since 1940, with an outline of problems and policies, was described by Colonel James P. Pappas of the Preventive Medicine Division, Office of the Surgeon General, Department of the Army.

CAMG activities relate to the commander's responsibilities in civil-military relationships. These range across a broad spectrum with civil affairs at one end involving relationships and agreements in friendly or allied territory to "full-blown" military government of enemy occupied territory at the other end with full executive, legislative, and judicial authority, within principles of international law. CAMG was identified as an "instrument of national policy," he said.

During the combat phase, military necessity (factors relating to winning the war) and compliance with the principles of international law (Geneva Convention) require the fullest possible support by CAMG and its public health staff. Of necessity during this phase, the operational responsibility for CAMG public health falls upon the surgeon who controls medical personnel, supplies, and transportation, he explained. Further, during this phase,

military operations control is along tactical lines unrelated to political and governmental territorial organization and channels.

In the postcombat, or static, phase, the role of CAMG and tactical forces are reversed. CAMG becomes the main force to win the peace, with the occupational forces acting for security and in support, he said.

Pappas favors the early civilianization of the CAMG organization, and, indeed, the policy of the Army is to have a civilian agency of the Government assume this function as soon as possible after cessation of hostilities. The military government responsibility was not completely transferred to a civilian agency of the Government until almost 5 years after cessation of hostilities.

In a summation of the management of public health by military authorities occupying Germany, he commented that the public health services had been more or less improvised in Sicily and Italy but had benefited from considerable planning in northwest Europe. Even so, there were but a dozen physicians with about the same number of paramedical personnel available for combat-support field public health work.

Following a review of the problems and principles of CAMG public health operations in Japan and Korea, Pappas pointed out that the Korean conflict stimulated organization and coordination among all Government agencies and the Joint Chiefs of Staff designated the Chief of Staff, United States Army, as executive agent for CAMG for advice, planning, and coordination.

CAMG public health involves all the skills and techniques and problems of a national ministry of health and provincial and city health departments—only it is much more complicated and frustrating. It is surprising to some, though truistic enough in itself, that military government is government nevertheless with the ordinary problems and perplexities increased enormously.

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<i>Arkansas</i>		<i>Florida</i>		Columbus.....	2-17-1955
Fort Smith.....	8-26-1954	Jacksonville.....	8-27-1954	Dalton, Whitfield	
<i>Colorado</i>		<i>Georgia</i>		County.....	9- 9-1955
Boulder County.....	2-25-1955	Albany.....	12-16-1954	Dublin.....	3-18-1955
Colorado Springs.....	1-20-1954	Athens-Clarke County..	4- 8-1955	Elberton.....	2- 9-1954
Denver.....	10-28-1955	Atlanta.....	10-28-1955	La Grange.....	7-15-1954
Grand Junction and		Augusta-Richmond		Moultrie.....	11- 4-1955
Mesa County.....	4-15-1954	County.....	7- 2-1955	Quitman.....	8-25-1955
Las Animas-Huerfano		Cairo.....	2-25-1955	Savannah, Chatham	
Counties.....	3- 9-1954	Calhoun.....	7-23-1955	County.....	8-12-1954

# Communities awarded milk sanitation ratings of 90 percent or more 1954-55—Continued

## 100 PERCENT OF MARKET MILK PASTEURIZED—Continued

Community	Date of rating	Community	Date of rating	Community	Date of rating
<i>Georgia—Continued</i>		<i>Kentucky—Continued</i>		<i>North Carolina—Continued</i>	
Statesboro.....	12- 3-1954	Frankfort.....	7-23-1955	Charlotte.....	1- 4-1954
Swainsboro, Emanuel County.....	5- 5-1954	Fulton County.....	1-21-1954	Chatham County.....	4- 5-1955
Valdosta.....	4-29-1954	Georgetown.....	10-16-1954	Craven County.....	2-12-1954
Waycross.....	2- 4-1954	Hickman.....	1-20-1954	Cumberland County..	1-20-1954
<i>Idaho</i>		Hopkinsville.....	11-17-1955	Durham County.....	7-27-1954
Jerome.....	11-24-1954	Leitchfield.....	11-24-1954	Forsyth County.....	1-31-1955
<i>Illinois</i>		Louisville and Jefferson County.....	4- 7-1954	Guilford County.....	6-28-1954
Chicago.....	6-28-1955	Mayfield.....	9-16-1955	Henderson-Transyl- vania Counties.....	2-18-1954
<i>Indiana</i>		Monticello.....	7-13-1954	Iredell County.....	11-17-1954
Anderson.....	6- 9-1955	Morgantown.....	1- 8-1954	Lee County.....	4- 8-1955
Bedford.....	8-30-1954	Murray.....	4-29-1954	Lenoir County.....	1- 7-1955
Bloomington.....	6- -1954	Newport and Camp- bell County.....	10-20-1955	New Hanover County..	5-28-1954
Calumet region.....	5-26-1955	Owensboro.....	6-18-1954	Northampton County..	4-21-1954
East Chicago		Paducah.....	8- 5-1955	Onslow County.....	5-16-1955
Gary		<i>Louisiana</i>		Orange County.....	4- 5-1955
Hammond		Calcasieu Parish.....	8- -1954	Pender County.....	5-16-1955
Cooperative grade A milk program.....	6-28-1954	Lincoln Parish.....	9- -1954	Person County.....	4- 5-1955
Holland		Rapides Parish.....	5- -1954	Pitt County.....	4-20-1955
Huntingburg		St. Martin Parish.....	7- -1954	Richmond County.....	2- 2-1954
Jasper		Vermilion Parish.....	9- -1954	Rockingham-Caswell Counties.....	3-12-1954
Tell City		<i>Mississippi</i>		Tyrrell County.....	8- 5-1955
Crawfordsville.....	4-20-1955	Brookhaven.....	3- 4-1954	Washington County... <i>Oklahoma</i>	8- 5-1955
Elkhart.....	9- -1954	Clarksdale.....	10-13-1954	Ardmore.....	4- 8-1955
Evansville.....	12- 3-1954	Columbus.....	3-26-1954	Bartlesville.....	3- 8-1955
Greencastle.....	5-19-1954	Greenville.....	9-14-1954	Duncan.....	1-19-1954
Indianapolis.....	9-15-1954	Greenwood.....	4-19-1954	Guthrie.....	5-11-1955
La Fayette and West Lafayette.....	10-14-1954	Grenada.....	11-16-1955	Mangum.....	10-27-1955
Lake County.....	5- -1955	Houston.....	6- 1-1955	Okmulgee.....	3-16-1955
Crown Point		Iuka.....	7-19-1955	Seminole.....	10- 1-1954
Highland		Kosciusko.....	8-10-1955	Sulphur.....	2-17-1955
Hobart		Macon.....	6-11-1954	Tulsa.....	6-10-1955
Logansport.....	4- 9-1954	Meadville.....	10-13-1954	<i>Oregon</i>	
Madison.....	8- -1955	Picayune.....	11- 4-1955	Klamath Falls.....	5- 7-1954
Mount Vernon.....	10-18-1954	Ruleville.....	4-22-1954	<i>South Dakota</i>	
Muncie.....	11-23-1954	Vicksburg.....	7-10-1954	Aberdeen.....	8-28-1954
New Castle.....	11- -1954	West Point.....	5-26-1955	Sioux Falls.....	10-26-1954
Peru.....	2- -1955	<i>Missouri</i>		Sisseton.....	8-24-1954
Shelbyville.....	9- -1954	Cape Girardeau.....	8-11-1954	<i>Tennessee</i>	
Terre Haute.....	2- 3-1955	Kansas City.....	9-13-1954	Athens.....	8-10-1954
Valparaiso.....	5-13-1954	St. Joseph.....	6- 9-1955	Bristol.....	11- 3-1955
Vincennes.....	3- 7-1955	Springfield.....	11-25-1954	Chattanooga.....	12- 3-1954
<i>Iowa</i>		<i>Nevada</i>		Clarksville.....	2-10-1955
Dubuque.....	12- 2-1954	Ely, McGill, and Ruth	4-19-1955	Cleveland.....	10-13-1954
<i>Kentucky</i>		<i>North Carolina</i>		Clinton.....	4-21-1954
Bardstown.....	3- -1955	Avery County.....	1-15-1954	Columbia.....	5-19-1954
Bowling Green.....	1- 7-1954	Beaufort County.....	3-31-1955	Cookeville.....	9-21-1955
Brandenburg.....	8-12-1954	Bertie County.....	3-31-1955	Covington.....	11-12-1954
Campbellsville.....	4- 8-1955	Bladen County.....	6- 6-1955	Cowan.....	10-21-1954
		Burke County.....	1-15-1954		



# Communities awarded milk sanitation ratings of 90 percent or more 1954-55—Continued

## 100 PERCENT OF MARKET MILK PASTEURIZED—Continued

Community	Date of rating	Community	Date of rating	Community	Date of rating
<i>Tennessee—Continued</i>		<i>Texas—Continued</i>		<i>Virginia</i>	
Decherd.....	10-21-1954	Brownwood.....	7-16-1954	Bristol.....	11- 3-1955
Dyersburg.....	10-29-1954	Bryan.....	8-30-1954	Buena Vista.....	10-28-1955
Elizabethton.....	2-23-1955	Cleburne.....	11-19-1954	Front Royal.....	11-10-1955
Franklin.....	5-20-1954	Dallas.....	9-29-1954	Glasgow.....	10-28-1955
Gatlinburg.....	10- 6-1954	Denison.....	6-24-1954	Lexington.....	10-28-1955
Greenville.....	6- 5-1954	El Paso.....	10-25-1955	Luray.....	11-11-1955
Humboldt.....	6-30-1954	Falfurrias.....	1-21-1955	Norfolk.....	5-18-1954
Jefferson City.....	5-26-1954	Galveston.....	7-24-1954	Portsmouth.....	5-18-1954
Johnson City.....	9-23-1954	Harlingen.....	1-26-1955	Richmond.....	4-16-1954
Kingsport.....	11- 9-1955	Houston.....	5-28-1954	Roanoke.....	8-20-1954
Knoxville.....	8-26-1955	Huntsville.....	12- 3-1954	South Boston.....	3- 8-1954
Lebanon.....	8-27-1954	Jacksonville.....	12-11-1954	Staunton.....	6-25-1954
Lewisburg.....	6-10-1954	Kerrville.....	8-13-1954	Suffolk.....	7- 1-1954
Livingston.....	1-27-1954	Kilgore.....	7-14-1954	Waynesboro.....	6-25-1954
Loudon.....	5- 6-1954	Lufkin.....	3- 3-1955	Williamsburg.....	10-25-1955
Manchester.....	10-21-1954	Midland.....	1-21-1955	<i>Washington</i>	
Maryville-Alcoa.....	11-23-1954	Mineral Wells.....	12-14-1954	Spokane.....	9-16-1954
Memphis.....	3-25-1954	Nacogdoches.....	9- 3-1954	Whitman County.....	10-14-1954
Milan.....	6-30-1954	New Braunfels.....	9- 2-1954	<i>Wisconsin</i>	
Morristown.....	5-26-1954	Odessa.....	1-21-1955	Baraboo.....	10-18-1955
Murfreesboro.....	7-14-1955	Orange.....	5-19-1955	Beaver Dam.....	3-29-1955
Nashville and Davidson County.....	10-27-1955	Plainview.....	11- 2-1954	Burlington.....	12- 5-1954
Newbern.....	10-28-1954	Port Arthur.....	6-29-1954	Delavan.....	12- 5-1954
Newport.....	10- 5-1954	San Antonio.....	2- 8-1955	Elkhorn.....	12- 5-1954
Pulaski.....	9- 1-1955	San Benito.....	1- 8-1955	Fontana.....	12- 5-1954
Shelbyville.....	6- 9-1954	Sweetwater.....	11-17-1954	Fort Atkinson.....	12- 5-1954
Sparta.....	5- 5-1954	Texarkana.....	4- 5-1955	Green Bay.....	10- 6-1955
Springfield.....	7-23-1955	Tyler.....	10-22-1954	Kenosha.....	7-14-1955
Sweetwater.....	10- 7-1954	Victoria.....	11-24-1954	La Crosse.....	1-14-1955
Trenton.....	6-30-1954	Wichita Falls.....	3- 8-1955	Lake Geneva.....	12- 5-1954
Winchester.....	10-21-1954			Manitowoc.....	5-11-1955
<i>Texas</i>		<i>Utah</i>		Ripon.....	3-29-1955
Beaumont.....	5-24-1955	Ogden.....	10-18-1955	Sheboygan.....	7- 7-1955
Brownfield.....	5- 6-1955	Salt Lake City.....	3-30-1954	Waupun.....	3-29-1955
				Williams Bay.....	12- 5-1954

## BOTH RAW AND PASTEURIZED MARKET MILK

Community and percent of milk pasteurized	Date of rating	Community and percent of milk pasteurized	Date of rating	Community and percent of milk pasteurized	Date of rating
<i>Florida</i>		<i>Georgia—Continued</i>		<i>Georgia—Continued</i>	
Escambia County, 99.6	6-30-1954	Gainesville-Hall County, 92.1.....	5-20-1955	Pelham, 94.....	9- 7-1955
<i>Georgia</i>		Griffin, 98.2.....	9- 3-1954	Thomaston, 87.4.....	6-17-1954
Carroll County, 97.5..	3-24-1955	Macon, 99.7.....	6-23-1955	Toccoa-Stephens County, 88.....	4- 9-1954
Cartersville, 97.7....	1-26-1955	Marietta, 96.2.....	5- 4-1954	Washington, 99.7....	11-18-1955
Cedartown, 97.7.....	11-19-1954	Newnan, 92.8.....	7-23-1954	Winder-Barrow County, 98.5.....	3-10-1955

# Communities awarded milk sanitation ratings of 90 percent or more, 1954-55

## BOTH RAW AND PASTEURIZED MARKET MILK

<i>Community and percent of milk pasteurized</i>	<i>Date of rating</i>	<i>Community and percent of milk pasteurized</i>	<i>Date of rating</i>	<i>Community and percent of milk pasteurized</i>	<i>Date of rating</i>
<i>Idaho</i>		<i>Oklahoma</i>		<i>Texas—Continued</i>	
Twin Falls, 98.96.....	4-15-1954	Altus, 94.2.....	5- 5-1955	Austin, 98.6.....	6-11-1954
		Elk City, 99.....	4-22-1955	Brady, 94.....	8- 7-1954
<i>Kentucky</i>		Enid, 98.....	5- 5-1955	Childress, 83.4.....	4-22-1955
		Henryetta, 93.....	3-14-1955	Fort Worth, 99.97....	4-28-1954
Henderson, 98.9.....	9-23-1954	Lawton, 99.2.....	12-27-1954	Gainesville, 95.....	12- 1-1954
Princeton, 96.....	5-19-1955	McAlester, 79.....	6-29-1955	Gladewater, 98.8.....	7-14-1954
Somerset, 95.....	2- 7-1955	Muskogee, 99.6.....	1-21-1955	Longview, 99.6.....	7-14-1954
<i>Missouri</i>		Norman, 99.....	1-27-1955	Lubbock, 99.....	8-20-1954
		Oklahoma City, 97.9..	11- 4-1955	Marshall, 91.....	4-26-1954
Moberly, 94.2.....	3- 1-1955	Ponca City, 94.6.....	4-14-1955	Palestine, 95.1.....	6-15-1954
Poplar Bluff, 97.4.....	8-18-1955	Shawnee, 98.8.....	11-18-1955	Paris, 94.8.....	12- 8-1954
		Stillwater, 97.....	4-29-1954	Waco, 99.....	7-28-1954
<i>Montana</i>		<i>Oregon</i>		<i>Virginia</i>	
		Portland, 99.4.....	7-30-1955	Charlottesville, 99.4...	10-17-1955
Missoula, 99.....	11- 5-1954	<i>Tennessee</i>		Lynchburg, 98.8.....	12....1954
<i>North Carolina</i>		McMinnville, 90.....	5- 5-1954	<i>Washington</i>	
		<i>Texas</i>		Tacoma, 99.7.....	7-16-1954
Moore County, 93.6..	3-12-1954	Abilene, 98.9.....	6-15-1954	<i>West Virginia</i>	
Robeson County, 96.8..	1-11-1954	Amarillo, 99.3.....	4-11-1955	Kanawha County, 98..	6-25-1954

NOTE: In these communities the pasteurized market milk shows a 90-percent or more compliance with the grade A pasteurized milk requirements, and the raw market milk shows a 90-percent or more com-

pliance with the grade A raw milk requirements, of the Milk Ordinance and Code Recommended by the United States Public Health Service.

Note particularly the percentage of the milk pasteurized in the various

communities listed. This percentage is an important factor to consider in estimating the safety of a city's milk supply. All milk should be pasteurized, either commercially or at home, before it is consumed.

## International Symposium on Venereal Diseases

The First International Symposium on Venereal Diseases and the Treponematoses will be held at the Statler Hotel, Washington, D. C., May 28-June 1, 1956. The symposium is sponsored by the Public Health Service and the World Health Organization.

This meeting will afford an opportunity for authorities from many lands to exchange ideas and information on developments in research, diagnosis, treatment, and case finding in the venereal and treponemal diseases. The working languages of the symposium will be French, Spanish, and English. Papers will be interpreted in all three languages during the course of the meeting.

# ULTRAVIOLET STERILIZATION

## *in Microbiological Laboratories*

A discussion of the germicidal protection offered by ultraviolet lamps installed in airlocks, at doorways, and on ceilings of microbiological laboratories and walk-in incubators.

By ARNOLD G. WEDUM, M.D., EVERETT HANEL, Jr., B.S., and G. BRIGGS PHILLIPS, B.S.

ULTRAVIOLET radiation has been used for a number of years in some infectious disease laboratories to provide barriers between hazardous and safe areas and to reduce bacterial contamination.

The decision, by the authors, to recommend installation of ultraviolet lamps in airlocks, in doorways, and on ceilings of selected laboratories and walk-in incubators was made after experiments showed that ultraviolet radiation could be used to separate areas of unequal infectious risk.

Earlier reports dealt with ultraviolet radiation for sterilizing small volumes of bacterially contaminated air and for treating single sheets of paper passed from infectious areas (1, 2).

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*Dr. Wedum is safety director, Fort Detrick, Army Chemical Corps, Frederick, Md. Mr. Hanel is chief of the Agent Control Branch, Safety Division, Fort Detrick, and Mr. Phillips is a bacteriologist with the Safety Division. This report is one in a series.*

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Wedum (3) also mentioned the use of ultraviolet racks for cages housing infected animals.

### Experimental Methods

Cultures of *Serratia indica* were used in most of our studies. In some tests, normal bacterial flora of the air or surface contaminants were used as indicators of germicidal effectiveness. Aerosols of *S. indica* were produced from 24-hour broth cultures by a DeVilbiss No. 40 nebulizer.

To evaluate the effectiveness of ultraviolet (UV) installations, air was sampled for bacterial content by sieve air samplers (4) with the UV lamps off and on. In some instances liquid impinger samplers were used for the UV-off air samples. The comparative number of organisms recovered and the percent reduction allowed an estimation of the effectiveness of the germicidal radiation.

During these studies some attention was given to the phenomenon of photoreactivation, first described by Kelner (5). Recovery plates

were sometimes prepared in duplicate and incubated under white light and in the dark. However, our experiments called for lethal concentrations of ultraviolet radiation and were performed during the day when generous amounts of white light were present before and during the tests, and no photoreactivation was demonstrated. The average relative humidity in the laboratories during these studies was 56 percent.

## Airlocks

In this paper an airlock is defined as a small empty room with a door at each end, constructed to create a dead airspace for a safer passage-way between two areas. Germicidal lamps were installed on the ceiling of a variety of

such rooms and experiments were conducted to determine the effectiveness of ultraviolet radiation in preventing the passage of airborne micro-organisms from area to area.

Tests conducted with one typical airlock illustrate the effect of germicidal radiant energy. Three 30-watt UV lamps were installed on the ceiling in an airlock 8 feet long, 3½ feet wide and 10 feet high. Movement of air between the rooms separated by this airlock was controlled during testing by means of exhaust fans, although in practice the room of greater infectious hazard is kept at a negative pressure.

A meter employing a WL-775 Tantalum photocell and calibrated for response at wavelength 2537A was used to determine the radiant intensities of energy throughout the airlock. All measurements were taken on a horizontal

Table 1. Ultraviolet intensities in an 8' x 3½' x 10' airlock equipped with three 30-watt lamps

Distance from floor level (inches)	Microwatts per square centimeter						
	Distance in feet from north to south end						
	1	2	3	4	3	2	1
8.....	10	38	43	44	41	40	33
24.....	33	43	44	49	50	48	46
40.....	52	56	57	59	59	59	54
60.....	81	81	80	75	75	74	85
90 (30 inches below ceiling).....	157	118	115	147	112	110	144

Table 2. Bacteriological tests of an ultraviolet airlock using *Serratia indica* as the test organism

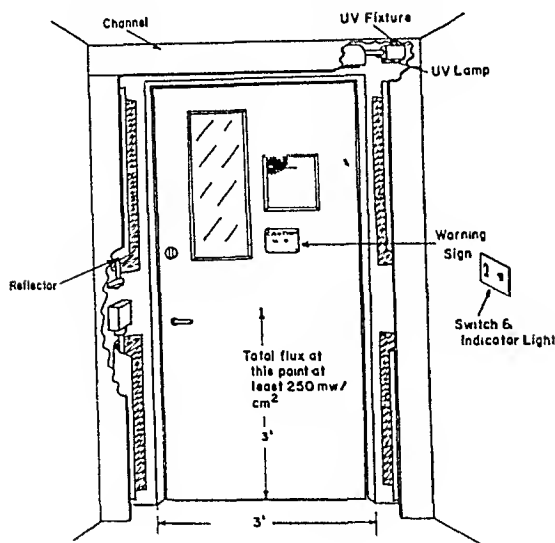
Test number	Air velocity, feet per second	Position of airlock doors	Cloud concentration per cubic foot of air			Percent reduction of <i>S. indica</i>
			At nebulizing position	At collection point past the airlock		
				UV on	UV off	
1.....	2	open.....	408	0.4	43	99
2.....	2	open.....	938	0	81	100
3.....		open.....	3,347	0.8	334	99
4.....	(1)	closed.....	110,600	14	2 11,600	99

<sup>1</sup> Leakage around door.

<sup>2</sup> Estimated.

NOTE: No *S. indica* appeared in control air samples taken before each test. Organisms passing through the airlock were collected with sieve samplers for 5 minutes at 1 cfm. Liquid impingers were used to determine the number of organisms per cubic foot of air at the point of nebulization. The collection efficiency of the samplers is estimated at 95 percent for the liquid impinger and 45 to 70 percent for the sieve sampler.

## Ultraviolet lamp installation at doorway.



plane, and the radiation measured represented energy received from above. With the exception of one reading, all areas received at least 30 microwatts per sq. cm. (table 1).

Bacteriological tests were conducted with the doors open and closed. Aerosols of *S. indica* were produced outside the airlock on the upwind side, and samples were taken outside the airlock on the downwind side. The bacterial aerosol concentration was controlled by nebulizing a culture that had been diluted to the desired concentration. Generation of the aerosol continued throughout each test. The results show at least a 99-percent reduction of the bacterial aerosol in every case (table 2). Our experience with a variety of similarly radiated airlocks has shown that few, if any, airborne vegetative bacteria or bacteriophage particles will penetrate such a barrier if air velocities of about 2 feet per second are involved and if the number of UV lamps attached to the ceiling provide a floor intensity of 20 to 30 microwatts per sq. cm.

### Doorway Barriers

In the absence of an airlock, an effective barrier can be made by providing a radiation screen across a doorway. A design we recommend for this purpose uses five 17-watt cold cathode UV lamps with aluminum reflectors placed in a wood or metal channel built around the door-

way (see drawing). The channel is placed so that the door opens away from the barrier. In this manner a screen of high intensity ultraviolet radiation is projected across the doorway.

Typical ultraviolet intensities obtained with a door barrier are shown in table 3. Intensity measurements in microwatts per square centimeter from three directions have been added and arbitrarily designated as the "total energy flux."

For bacteriological testing of the typical UV door barrier, cultures of *S. indica* were nebulized either on the upwind or downwind side of the barrier while sieve air samplers were operated on the opposite side. Two conditions were included which reversed momentarily the normal airflow pattern. For example, the pumping action of another door in the room on the positive pressure side (upwind, clean side) would pull airborne organisms from the contaminated room through the barrier door. Similarly, the opening of the barrier door momentarily destroyed the pressure balance and airborne organisms entered the positive pressure clean area.

The results of these experiments are summarized in table 4. In brief, if the total energy flux (table 3) is at least 250 microwatts per sq. cm. at the midpoint in the barrier (see drawing) the ultraviolet radiation will provide significant germicidal action.

### Laboratory Ceilings

Unshielded UV lamps can be installed on the laboratory ceiling to provide germicidal treat-

**Table 3. Ultraviolet intensities in microwatts per square centimeter at the vertical middle of a door barrier**

Feet above the floor	Radiation from above	Radiation from left	Radiation from right	Total energy flux received
6-----	166	142	144	452
5-----	96	126	126	348
4-----	66	113	110	289
3-----	52	126	144	322
2-----	36	96	120	252
½-----	28	40	30	98

were sometimes prepared in duplicate and incubated under white light and in the dark. However, our experiments called for lethal concentrations of ultraviolet radiation and were performed during the day when generous amounts of white light were present before and during the tests, and no photoreactivation was demonstrated. The average relative humidity in the laboratories during these studies was 56 percent.

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<sup>1</sup> Leakage around door.

<sup>2</sup> Estimated.

NOTE: No *S. indica* appeared in control air samples taken before each test. Organisms passing through the airlock were collected with sieve samplers for 5 minutes at 1 cfm. Liquid impingers were used to determine the number of organisms per cubic foot of air at the point of nebulization. The collection efficiency of the samplers is estimated at 95 percent for the liquid impinger and 45 to 70 percent for the sieve sampler.

Table 5. Reduction of airborne bacteria by ultraviolet radiation in four test rooms

Room number	Cubic feet in room	Average bacterial count per cubic foot of air before lamps were on	Lamps on 1 hour						1st 20 minutes bacteria per cubic foot	2d 20 minutes bacteria per cubic foot
			1st 20 minutes		2d 20 minutes		3d 20 minutes			
			Count per cubic foot	Percent reduction	Count per cubic foot	Percent reduction	Count per cubic foot	Percent reduction		
1-----	1, 900	13. 6	4. 6	66. 0	4. 5	67. 0	1. 9	86. 0	4. 1	5. 3
2-----	1, 900	17. 7	10. 4	40. 0	7. 4	58. 0	4. 4	75. 0	7. 4	11. 0
3-----	375	33. 0	4. 4	87. 0	2. 5	92. 5	2. 7	91. 8	4. 2	6. 6
4-----	1, 900	13. 6	3. 2	75. 5	2. 1	84. 5	1. 7	87. 5	4. 7	6. 9
Averages-----	-----	19. 47	5. 65	71. 0	4. 1	79. 0	2. 7	86. 0	5. 1	7. 45

ceived approximately 13 microwatts per sq. cm.

During the 6-day test for each condition, normal use of the incubator was continued. The bacteria and fungi recoverable from the air by sieve samplers and from the walls by moistened sterile swabs during the test periods were reduced by 83 to 100 percent as compared to the controls (table 6). Indirect UV radiation reduced the number of micro-organisms on the floor only slightly. Direct radiation caused an 86.5-percent reduction in floor bacteria on exposed surfaces, but the reduction in numbers of fungi was not determined because of overgrowth by bacteria in the control samples.

Obviously, when ultraviolet is used, the microbial population is reduced and then remains

Table 6. Reduction of organisms by continuous ultraviolet in an incubator room (30° C.)

Condition tested	Percent reduction by ultraviolet <sup>1</sup>			
	Indirect ultraviolet		Direct and indirect ultraviolet	
	Bacteria	Fungi	Bacteria	Fungi
Airborne organisms-----	83. 4	84. 7	91. 8	84. 7
Organisms on the floor----	( <sup>2</sup> )	( <sup>2</sup> )	86. 5	( <sup>3</sup> )
Organisms on the walls----	99. 4	92. 0	100	100

<sup>1</sup> Averaged from samples in triplicate taken on each of 6 days.

<sup>2</sup> Very little reduction.

<sup>3</sup> Reduction not determined.

rather constant. Equilibrium conditions were maintained although normal use of the incubator continued. When indirect UV was used, all air samples were taken close to the floor where no radiation was present. Air circulation was therefore responsible for lower air counts in all parts of the incubator. Of course, no decontamination occurred on surfaces not exposed to radiation.

The reduction of fungi was about the same as for bacteria, in spite of the fact that molds are considered to be 100 to 1,000 times as resistant as bacteria (6). This parallelism suggests that the exposure times used were sufficient to kill even the hardest micro-organisms, and, in reality, the limiting factor for destruction was the ability or inability of the radiation to reach the cells.

In an additional series of tests, when 4 ml. of an *S. indica* culture ( $2 \times 10^7$  cells per ml.) were nebulized in the incubator, all airborne cells were eliminated in 1 minute by direct and indirect radiation and in 10 minutes by indirect radiation alone. With the UV lamps off, *S. indica* was recovered for 1 hour.

In unreported studies, in which agar plates inoculated with *Brucella abortus*, strain A-19, or *S. indica* were placed in a walk-in incubator room equipped with UV lamps, we have observed that those agar plates placed 3 feet or closer to the lamps must be shielded continuously from the radiations to prevent inhibition of colony growth. Since 2537A radiations will not penetrate ordinary glassware, colony inhibition at distances shorter than 3 feet is

ment of the air and exposed surfaces during periods when the room is unoccupied. Lamps can also be turned on in case of accidental spillage of infectious materials and just before or during pouring of sterile media. We recommend that ceiling lamps be located to provide an intensity of 5 to 10 microwatts per sq. cm. on exposed floor surfaces.

Experiments were conducted in four rooms to determine the reduction in normal airborne bacteria when two 30-watt UV lamps, attached on the ceiling of each room, were turned on for 1 hour. Doors and windows of the rooms were closed and activity held to a minimum during the experiments. Air in the room was sampled for bacterial content with sieve samplers before, during, and after the 1-hour ultraviolet treatment. Samples were taken at the tabletop level with each sampler shielded from direct radiation. The experiment was repeated three times in each laboratory; the averaged results are shown in table 5.

One hour irradiation resulted in an 86-percent decrease in normal airborne bacteria. Common spore-forming bacteria were predominant in the UV-on samples. The number of airborne bacteria increased shortly after the lamps were turned off.

#### Walk-In Incubators

Conditions in walk-in incubators are generally favorable for the survival or growth of

contaminating micro-organisms. Since incubators usually are not ventilated, the microbial population may be quite high. When infectious cultures are incubated, escape of pathogens from broken flasks or from flasks with missing stoppers may constitute a hazard to persons entering the incubator. Breakage or spillage on a shaking machine or from a culture aeration apparatus may be especially dangerous.

Evaluation studies were made of the effectiveness of ultraviolet radiations in reducing surface and airborne microbial flora in a 9 x 8 foot walk-in incubator room with an 8-foot ceiling. Triplicate samples of air and surfaces in the room (30° C.) were taken for 6 days under three separate conditions and examined for common bacteria and fungi. The conditions were:

1. Control—no ultraviolet.

2. Indirect ultraviolet—one 17-watt cold cathode UV lamp mounted 8 inches below the ceiling in the center of the room and shielded to irradiate upwards.

3. Indirect and direct ultraviolet—condition (2) plus one 17-watt lamp mounted 12 inches below the ceiling and irradiating downward.

With indirect ultraviolet, radiation of from 8 to 35 microwatts per sq. cm. (due mostly to reflectance) was present on the upper shelves in the room, but no radiation reached the floor. When both lamps were burning, 17 to 82 microwatts per sq. cm. of radiant energy was present on the shelves, and the exposed floor area re-

Table 4. Bacteriological tests of an ultraviolet door barrier

Test conditions	Point of nebulization of <i>Serratia indica</i>	Position of sieve samplers	Cloud concentration per cubic foot of air			Percent efficiency of UV door barrier
			At nebulizing point	At collection point by sieve samplers		
				UV on	UV off	
Hall door closed-----	Positive pressure side.	Negative pressure side.	40	0	5.4	100
Outside door opened 10 times.	Negative pressure side.	Positive pressure side.	214,000	0.2	58	99.7
Two entrances and two exits by man.	Negative pressure---	Positive pressure side.	214,000	13.2	178	92.5

NOTE: No *S. indica* appeared in control air samples taken before each test. Organisms passing through the barrier were collected with sieve samplers for 5 minutes at 1 cfm. Liquid impingers were used to determine the number of organisms per cubic foot of air at the point of nebulization. The collection efficiency of these samplers is estimated at 95 percent for the liquid impinger and 45 to 70 percent for the sieve sampler.



| *In New Jersey, allocation of State funds to local projects is proving successful in assisting control of chronic illness.*

## State Grants for Local Projects in Chronic Illness Control

By A. L. CHAPMAN, M.D., M.P.H., and DANIEL BERGSMA, M.D., M.P.H.

"The growing problem of prevention, detection, and care of chronic illness, which is of such a character as not to be exclusively medical, educational, or welfare, has reached such proportions in this State as to require the participation of the State and of the agencies administering public health, education, and welfare within the State, and it has been declared by statute to be the public policy of this State that the responsibility therefor must be shared by the State and the counties and the several municipalities and health districts and voluntary agencies and institutions within the State and the public at large."

THIS statement of public policy is taken from the Prevention of Chronic Illness Act of New Jersey. It represents another evolutionary step in the development of a chronic illness control program in this State—a program which began in 1949 when the Governor appointed a Temporary Committee on the Chronic Sick. The Prevention of Chronic Illness Act, passed in 1952, also called for the establishment of a division of chronic illness control in the State health department, the appoint-

ment of an Advisory Council on the Chronic Sick, and the selection of a Committee of Technical Advisors.

In December of 1952, the Governor called the first of a series of governor's conferences on chronic illness. This conference served to focus the attention of both professional and non-professional health leaders on the importance of the chronic illness problem and the need for concerted effort to solve it. Following this conference the decision was made to allocate State chronic illness funds to local sponsors.

State aid for locally sponsored projects was not a new concept in New Jersey. The basic laws of that State emphasize "home rule." The State health department has for several years contracted with local health departments for the provision of certain local health services. This policy, with only one important change, was simply extended to cover services for the chronically ill. The chronic illness grants-in-aid, however, are not limited to local health departments as are other grants-in-aid. Local boards of chosen freeholders, local nonprofit hospitals, and local voluntary agencies also can sponsor chronic disease grant-in-aid projects.

### Contract Specifications

Contracts covering the State-local grants-in-aid are between the State health department and the local sponsor. They call for the provision of specific services in return for a grant-

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*Dr. Chapman is Public Health Service regional medical director, Region II of the Department of Health, Education, and Welfare, New York City. He was at one time chief of the former Division of Chronic Disease Control, Public Health Service. Dr. Bergsma is State health commissioner of New Jersey.*

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presumably due to the longer wavelengths emitted by the lamps. Ultraviolet radiation is not recommended for incubators if it is critically important to preserve the genetic or nutritional characteristics of the micro-organisms in use.

### Safety Measures

Skin or eye protection is not usually required for persons walking through ultraviolet barriers. Protection is required, however, for persons exposed to the radiation for longer than a few seconds. Personnel must be trained not to look at the UV lamps and not to loiter in an irradiated area. We recommend that warning signs and small blue indicator lights and switches be placed at each installation.

A regular maintenance program for lamp testing and cleaning is necessary. Lamps should be turned off and wiped with a soft cloth wet with alcohol. The frequency of cleaning will vary according to the conditions, but in any case the interval between cleaning should not be greater than 2 weeks. Of course, good training and good laboratory housekeeping is of prime importance in preventing the escape of harmful organisms from infectious disease laboratories.

### Conclusion

Ultraviolet radiation can be used around doorways and in airlocks to separate areas of unequal infectious risk and to reduce the number of infectious micro-organisms and general contaminants in laboratories and in walk-in incubators.

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## Methodology Research Award

Nominations for the Fifth Kimble Methodology Research Award are being accepted until June 1, 1956. This award is given in recognition of scientific investigations affecting public health laboratory techniques.

For rules governing nominations and information on nomination procedures, write to Dr. Thomas S. Hosty, chairman, Nominating Committee, Kimble Award, Bureau of Laboratories, Alabama State Department of Health, Montgomery 4, Ala.

A significantly large sum of money has been allotted to a medical center to provide screening services to patients of private physicians upon request. Five outpatient alcoholism clinics have been started in local hospitals.

Other local projects being developed through the grants-in-aid program include multiphasic screening of State employees, cervical cancer screening in demonstration hospitals, and screening for hearing defects and the rehabilitation of the hard of hearing in two hospitals.

This is not a complete list of the many local chronic disease projects in which the New Jersey State Health Department is participating. However, it does serve to indicate how quickly and effectively a large number of institutions, agencies, and people can become involved in developing local services for the chronically ill through the expenditure of a relatively small amount of money.

The chronic illness activities of the State health department are not limited to the allocation of grants-in-aid. The division of chronic illness control is responsible also for coordinating all health services which are designed to assist the chronically ill, for public and professional education, and for planning a long-range coordinated control program.

### **Achievement of Objectives**

The operation of a grant-in-aid program in no way negates the need for basic research work, the objective of which is to determine the causes of the degenerative and malignant diseases. Nor does it prevent the normal entrance of many nonsubsidized individuals, agencies, and institutions into the field of chronic illness control. The program does favor the more rapid achievement of several important public health objectives:

1. It almost automatically enlists the interest and support of many professional people in local chronic illness control activities.
2. It multiplies the resources and personnel engaged in chronic illness control.
3. It offers new opportunities for learning

how to provide local services that are better designed to find, treat, and rehabilitate the chronically ill.

4. It builds on spontaneous local interest where it exists. This tends to insure the efficient and economical administration of projects and favors their continuance when State aid is withdrawn.

5. It permits the State health department to exert leadership in the evolution of the chronic illness control program by selecting from among the many local applicants those that can contribute most effectively to the planned statewide program.

The rapid expansion of interest in New Jersey in chronic illness control is evidenced by the increasing popularity of the several governor's conferences which have been held since the original conference in 1952. Subsequent conferences have been held on diabetes, cardiovascular diseases, alcoholism, and new horizons in chronic illness control, including rehabilitation. All of these conferences have attracted large audiences and have resulted in excellent publicity. As a result, where originally there was a dearth of local applicants for the grant-in-aid funds, there now is a plethora.

The State-local chronic illness grant-in-aid mechanism in New Jersey is succeeding in increasing the number and quality of services offered locally to persons with chronic illness. Its important features are its simplicity of operation and its persuasiveness in obtaining the participation of local people in the solution of their own problems. Other State health departments might find that their chronic illness program can be accelerated by the adoption of the grant-in-aid mechanism.

Chronic disease grants-in-aid have proved to be, in part at least, an answer to a statement the Governor of New Jersey made in 1952: "Unless something is done by the way of effective prevention, there must inevitably be greater outlays for institutional care, and we must bear all the additional social costs—the costs in human suffering and in damaged family relationships."

in-aid, which may be in the form of money, personnel, or equipment.

When a grant-in-aid provides for the employment of personnel, the local sponsor recruits, hires, and supervises the personnel. This arrangement has proved to be more satisfactory than the assignment of State health department personnel to local projects because it gives the local agency a greater sense of responsibility for the project and because other employees accept the new employees as a part of their organization, subject to the same personnel policies. To insure the employment of qualified personnel, the State health department includes in the contract basic minimum qualifications for positions covered in each contract, based on State civil service standards. These qualifications must be met by employees recruited by local sponsors.

At periodic intervals the State health department checks the local program to make sure that the services contracted for are being provided.

Each contract provides for a specific termination date for State aid, after which the project must be maintained solely by the local sponsor. Gradual amortization is usually achieved. The contract may be terminated by either party 60 days after written notification has been given. It provides for quarterly payments to reimburse the local sponsor for actual expenditures, and it calls for the submission of quarterly reports to the State health department.

The contract also requires that the sponsor maintain proper records, make expenditures in accordance with budgets approved by the State health department, and accept general supervision and consultation by the State health department.

Federal grant-in-aid funds allocated to the State health department for the control of heart disease, cancer, and tuberculosis are not included in the State-local chronic illness grants-in-aid. They are allotted to local sponsors in much the same manner as State funds but under separate contracts. A single local sponsor may enter into one or more contracts with the State health department for the State-derived funds and also one or more contracts for federally derived funds.

## Scope of Program

The following table shows the planned expenditures for chronic illness grant-in-aid funds during the fiscal year 1955-56. In conformance with the Prevention of Chronic Illness Act, the expenditures are broken down into five general categories:

<i>Category</i>	<i>Amount</i>	<i>Per cent</i>
Early detection.....	\$102, 685	56
Prevention <sup>1</sup> .....	2, 500	1
Public health nursing and home-maker services.....	13, 300	7
Rehabilitation.....	47, 160	25
Research <sup>2</sup> .....	20, 049	11
Total.....	185, 694	100

<sup>1</sup> Primary prevention only.

<sup>2</sup> \$3,400 was allocated directly for research. In addition, 10 percent of the funds originally allocated for early detection and 10 percent of the funds originally allocated for rehabilitation were transferred to the research category.

To illustrate the diversity of activities and the broad geographic coverage that can be achieved by the use of State-local grants-in-aid, a few of the projects that have been or are being undertaken are mentioned.

Nine local hospitals have been assisted in developing multiple screening services for hospital personnel and all persons admitted to the hospital. Four hospitals are utilizing State aid to develop rehabilitation services. Two hospitals are engaged in evaluating screening tests related to diabetes control. Four community hospitals have made pilot studies of rheumatic fever prophylaxis.

The need for including bedside nursing among the services routinely offered by public health nurses has been recognized, and a study has been authorized to develop this type of program conversion. Seven community home-maker services are now functioning in New Jersey. One of these, organized on a county basis, is being assisted with a grant-in-aid to demonstrate the importance of a trained medical social worker in this field.

Two large projects are providing rehabilitation services in county institutions and hospital centers. For these projects, the grants-in-aid are in the form of trained personnel and labor-saving equipment.

ized sanitation program, that is, a program carried out by generalized, rather than specialized, personnel. However, both specialized programs and generalized programs have advantages and disadvantages. Which of the two is the more economical in terms of both cost and effectiveness remains to be determined.

All activities can be carried out by specialized personnel, but the data in table 3 indicate that certain activities are more often carried out by specialized personnel than others. Activities in the following areas were reported specialized by more than half the departments: plumbing, milk, pest and vector control, animal disease control, and industrial health.

**Table 1. Comparison of the 1951 and 1954 groups of local health departments included in the studies**

Population served	Number of departments reporting		Departments reporting in both 1951 and 1954	
	1951	1954	Number	Per cent of 1954
Less than 100,000-----	3	3	1	33
100,000-199,999-----	13	8	3	27
200,000-499,999-----	15	10	6	60
500,000 or more-----	10	14	11	79
Total-----	41	35	21	60

<sup>1</sup> Dallas, Tex., St. Louis County, Mo., and Jefferson County, Ala., were reported in the 200,000-499,999 group in 1951 and in the 500,000 or more group in 1954.

Although there are certain activities that are more amenable to generalization than others, the data in table 4 suggest that there may also be budgetary reasons for generalization. When grouped according to the percentage of activities specialized, the health departments varied little in the average number of activities performed. However, the average per capita budget and the average per capita expenditure per activity were nearly twice as much for the departments having the highest degree of specialization as for those with the least degree of specialization.

It would be presumptuous to conclude from these few data that an activity performed under

## Background of Report

This paper is based on an excerpt from a report of the Executive Committee of the Conference of Municipal Public Health Engineers. In addition to the material presented here, the report includes information on such items as salaries for directors of sanitation, sanitary engineers, sanitarians, and sanitary inspectors; policies on pay increases, holidays, overtime, vacations, sick leave, pensions, and reimbursement for transportation; professional background, educational level, and age distribution of professional sanitation personnel; and the number of clerical personnel in sanitation departments.

The study was initiated in 1954 by P. W. Purdom, director of the division of air pollution control and environmental sanitation, Philadelphia Department of Public Health, when he was chairman of the Conference of Municipal Public Health Engineers. The data were analyzed and compiled in report form by Walter A. Lyon, assistant chief of the environmental health section, Philadelphia Department of Public Health, and a member of the Conference of Municipal Public Health Engineers.

a generalized program costs less than the same activity under a specialized program. Nevertheless, such a conclusion would be supported to some extent by Fisher's observation that nearly one-third of a sanitarian's time is spent in travel (2). In a generalized program, the amount of travel is considerably reduced because (a) each sanitarian can cover a smaller geographic area and (b) overlapping of the same travel route by two or more sanitarians rarely occurs. To reach any valid conclusions concerning the economy of a generalized program, we would have to know more about the program coverage and the effectiveness of the activities in comparison with these facets of a specialized program.

## Program Costs

Comparison of budget figures for environmental health programs in various health departments needs to be approached with caution, particularly when the departments vary widely

# Environmental Health Program and Budget in Local Health Departments, 1954

**D**ATA on the administration of environmental health services in local health departments were obtained during 1954 by means of questionnaires sent to all members of the Conference of Municipal Public Health Engineers. Of the 39 replies received from members associated with local programs, 35 provided information with sufficient detail and completeness to be used in the study.

In a similar study in 1951, data were obtained from 41 local health departments. Many of these data are used here for comparison. However, because not all the departments that reported in 1951 were included in the 1954 study, comparisons between the two studies are not entirely valid. As shown in table 1, only 21 of the 41 departments that reported in 1951 also reported in 1954. There is more overlap among the departments serving populations of 200,000 or more than there is among the smaller departments.

Generally speaking, the proportion of large health departments in both the 1951 and the 1954 samples is greater than the proportion in the total number of local health departments. For example, in 1951 local health departments serving populations of 500,000 or more represented 2.2 percent of all full-time local health departments (1). In the 1951 study, they represented 24 percent of the sample, and in the 1954 study, 47 percent.

## Program Coverage

To obtain a picture of the program coverage provided by the 35 local health departments, analyses were made on the basis of 16 major

classifications, as shown in table 2. A health department was credited with an activity only if a comprehensive program was indicated. For example, animal disease control had to include more than just animal bite investigation.

Most of the departments (more than 80 percent) maintained routine inspection activities with respect to water, sewage, bathing places, food, and milk. More than half of the departments reported inspection activities in refuse disposal, meat, pest and vector control, institutions, and schools; and more than a quarter reported programs in housing, barber and beauty shops, air pollution, and industrial health. There seems to have been a significant increase in the number of departments reporting routine housing and air pollution control activities in 1954 as compared with 1951.

Some of the more recently recognized environmental health activities were being conducted by the following percentages of health departments: noise control, 24 percent; noxious weed control, 15 percent; home accident prevention, 27 percent; radiation protection, 35 percent.

In most of the program areas, fewer departments provided consultation services than routine inspection services. Exceptions to this were programs in plumbing, pest and vector control, animal disease control, air pollution control, and industrial health.

Of particular interest was the information reported on the degree of specialization in the administration of routine environmental health activities. In recent years there has been a trend in some departments toward a general-

capita sanitation program budgets. This exception was the 200,000-499,999 population group, for which the average per capita sanitation budget increased significantly between 1951 and 1954. As pointed out earlier, 6 of the 10 departments in this group reporting in 1954 also reported in 1951, and 3 of the remaining 4 reported considerably lower than average per capita sanitation budgets. Hence, most of the departments in the 200,000-499,999 group apparently received a significant increase in their sanitation program budgets during the 1951-54 period. That observation is substantiated by the fact that this group of departments was

the only one that reported a reduction in population per professional sanitation worker—from 15,300 to 14,500—between 1951 and 1954. For all departments, the population per professional sanitation worker increased from 13,300 in 1951 to 16,900 in 1954.

The 1954 average per capita sanitation program budget of 44 cents is four times the average amount (11 cents) spent by State health departments for environmental health services in 1950 (3). Environmental health divisions in local health departments absorbed, on the average, 25 percent of the total health department budget, whereas in State health departments

**Table 4. Average per capita budget, average population served per professional worker, average number of activities, and average per capita cost per activity for 35 local health departments grouped according to degree of specialization, 1954**

Percent of activities specialized	Number of health departments	Average per capita budget	Average population per professional worker <sup>1</sup>	Average number of activities	Average per capita cost per activity
0-24.9-----	14	\$0. 307	22, 000	8. 4	\$0. 037
25-49.9-----	13	. 488	14, 300	10. 0	. 048
50-74.9-----	4	. 639	12, 250	9. 8	. 065
75-100.0-----	4	. 576	12, 300	8. 3	. 070

<sup>1</sup> All sanitation personnel, except clerical and labor.

**Table 5. Budget data for local health departments, by population served, 1951 and 1954**

Population served	Year	Number of departments reporting	Per capita budget								
			Average			Maximum			Minimum		
			Total	Sanitation	Percent sanitation of total	Total	Sanitation	Percent sanitation of total	Total	Sanitation	Percent sanitation of total
Less than 100,000-----	{1951-----	3	\$1. 75	\$0. 37	21. 2	\$2. 75	\$0. 65	23. 6	\$0. 60	\$0. 16	26. 7
	{1954-----	3	1. 40	. 34	24. 3	1. 95	. 51	33. 9	. 75	. 18	17. 2
100,000-199,999-----	{1951-----	11	1. 47	. 39	26. 5	2. 85	1. 02	35. 8	. 66	. 17	25. 7
	{1954-----	8	1. 70	. 39	22. 9	2. 59	. 56	41. 2	1. 11	. 19	14. 5
200,000-499,999-----	{1951-----	10	1. 17	. 33	28. 3	2. 01	. 45	22. 3	. 68	. 15	22. 1
	{1954-----	10	1. 62	. 53	32. 7	2. 56	. 96	87. 7	. 84	. 19	13. 0
500,000 or more-----	{1951-----	8	1. 86	. 45	24. 2	3. 00	. 69	23. 0	1. 20	. 29	24. 1
	{1954-----	14	1. 73	. 43	24. 8	2. 70	. 88	40. 0	. 60	. 11	10. 8
All departments-----	{1951-----	32	1. 50	. 38	25. 4	3. 00	1. 02	35. 8	. 60	. 15	22. 1
	{1954-----	35	1. 66	. 44	26. 5	2. 70	. 96	87. 7	. 60	. 11	10. 8

**Table 2. Types of services provided by local health departments in specified environmental sanitation activities, 1954**

Activity	Routine inspection service		Consultation service		Routine inspection and consultation service	
	Number	Percent <sup>1</sup>	Number	Percent <sup>1</sup>	Number	Percent <sup>1</sup>
Water.....	30	85.8	26	74.4	22	62.9
Plumbing.....	8	22.9	10	28.6	2	5.7
Sewage.....	30	85.8	24	68.6	20	57.1
Bathing places.....	32	91.5	18	51.4	15	42.9
Refuse disposal.....	19	54.2	18	51.4	11	31.4
Food.....	34	97.0	14	40.0	13	37.1
Meat.....	25	71.4	12	34.3	8	22.9
Milk.....	31	88.5	14	40.0	13	37.2
Pest and vector control.....	19	54.2	24	68.6	12	34.3
Animal diseases.....	3	8.6	7	20.0	3	8.6
Housing.....	16	45.7	10	28.6	7	20.0
Barber and beauty shops.....	9	25.7	7	20.0	4	11.4
Institutions.....	21	60.0	17	48.6	9	25.7
Schools.....	23	65.8	17	48.6	11	31.4
Air pollution.....	10	28.6	15	42.9	7	20.0
Industrial health.....	10	28.6	18	51.4	5	14.3

<sup>1</sup> All 35 health departments=100 percent.

in terms of population served and scope of program, as do those included in this study. Nevertheless, such data give some idea as to the amount people are willing to pay for environmental health services.

Budget data for the 35 local health departments, which served populations ranging from 18,000 to 2,000,000, are given in table 5. The average per capita sanitation program budget was 44 cents, with a range of 11 cents to 96 cents. Although the variation was rather wide, there were health departments in each population group with budgets near each end of this range. Environmental health divisions which were on the lower end of the per-capita-budget scale were also receiving a smaller portion of the health department budget. For example, environmental health divisions that reported a budget of less than 25 cents per capita received a median 18 percent of the health department budget, whereas those with a budget of 75 cents or more per capita received a median 40 percent of the health department budget.

The average per capita cost per sanitation activity was 4.8 cents. (As used here, and elsewhere in this report, "activity" refers to such program classifications as those listed in tables 1 and 2.)

For comparison with the 1954 data, the budget

data reported by 32 health departments in 1951 are also given in table 5. The average per capita health department budget was somewhat greater in 1954 than in 1951 for the larger departments. However, with the exception of one population group, there was little difference between the 1951 and the 1954 average per

**Table 3. Degree of specialization in environmental sanitation activities, 1954**

Activity	Local health departments reporting		
	Total number	Number specialized	Percent specialized
Water.....	30	4	13
Plumbing.....	8	5	63
Sewage.....	30	4	13
Bathing places.....	32	4	13
Refuse disposal.....	19	0	0
Food.....	34	13	38
Meat.....	25	12	48
Milk.....	31	27	90
Pest and vector control.....	19	11	58
Animal diseases.....	3	3	100
Housing.....	16	6	38
Barber and beauty shops.....	9	1	11
Institutions.....	21	1	5
Schools.....	23	2	9
Air pollution.....	10	0	0
Industrial health.....	10	6	60



*Most of the recent reports on infectious hepatitis epidemics have concerned children in schools and institutions. The subjects of the epidemic in the Elgin State Hospital were adult mental patients.*

# Infectious Hepatitis Epidemic in a Mental Hospital

By OTTO L. BETTAG, M.D., FREDERICK PLOTKE, M.D.,  
WERNER TUTEUR, M.D., and GUDRUN HERBORN, M.D.

**D**ISCOVERY of any communicable disease in a mental hospital is cause for special concern. The inability or reluctance of many patients to verbalize their physical complaints frequently minimizes or rules out the possibility of early discovery and treatment. Then, too, overcrowded living quarters, intimate contact, and promiscuous defecation habits are conducive to the extension of communicable disease.

For a disease such as infectious hepatitis, poor personal hygiene and resultant unsanitary conditions constitute particularly formidable obstacles to the development of effective control measures. Certain segments of the patient population, by the very nature of their mental illness, are unable or unwilling to cooperate fully in control measures necessary to reduce the danger of an epidemic.

Thus, at Illinois' Elgin State Hospital for the mentally ill, about 40 miles northwest of

Chicago, such conditions contributed to the spread of infectious hepatitis cases, which occurred in unprecedented number from October 20, 1953 to March 15, 1954. Altogether there were 100 cases in the adult patient population of about 6,800 (see table).

Ninety-five of the 100 cases occurred in three overcrowded cottages on the north side of the grounds, Hirsch, Holden, and Hawley, housing regressed and untidy women patients. The remaining 5 cases occurred in 4 widely scattered cottages and wards for men, located on the opposite side of the grounds (fig. 1). Two of the men's cottages, Wilson, 1 case, and Kilbourne, 2 cases, housed deteriorated and untidy patients.

In general the epidemic did not follow a definite pattern. Explosive outbursts in the three women's wards were followed by a leisurely development of secondary cases. Among the men, 3 of the 4 wards developed no additional cases. Brodribb (1) and others have noted the appearance of cases in periodic batches, approximating monthly intervals.

The highest concentration of cases appeared at Hirsch Cottage, where the first two cases were found on October 20, 1953. From that date until February 13, 1954, there were 62 infectious hepatitis cases among the 267 severely regressed residents, an attack rate of 23 percent

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*Dr. Bettag is director of the Illinois Department of Public Welfare. Dr. Plotke, chief of the department's public health service, was recently appointed assistant clinical professor of preventive medicine at the Stritch School of Medicine, Loyola University. Dr. Tuteur is clinical director and Dr. Herborn is staff physician at the Elgin State Hospital in Illinois.*

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only 7 percent of the total health department budget was spent for environmental sanitation in 1950 (4). Although State expenditures for all health services increased by 245 percent during the period 1940 to 1950, expenditures for environmental health increased only 31 percent.

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## Constitutionality of Temporary Committal Of the Mentally Ill by Medical Certification

The Supreme Judicial Court of Maine in the case of *In re Opinion of the Justices*, 117 A. 2d 63 (May 18, 1955), has held that a statute may constitutionally provide for the temporary confinement (35 days) of a mentally ill person who is certified by a physician as being "likely to injure himself or others if not immediately restrained" provided that the statute also provides adequate methods by which persons so hospitalized may "institute (judicial) proceedings to test the necessity of their commitment."

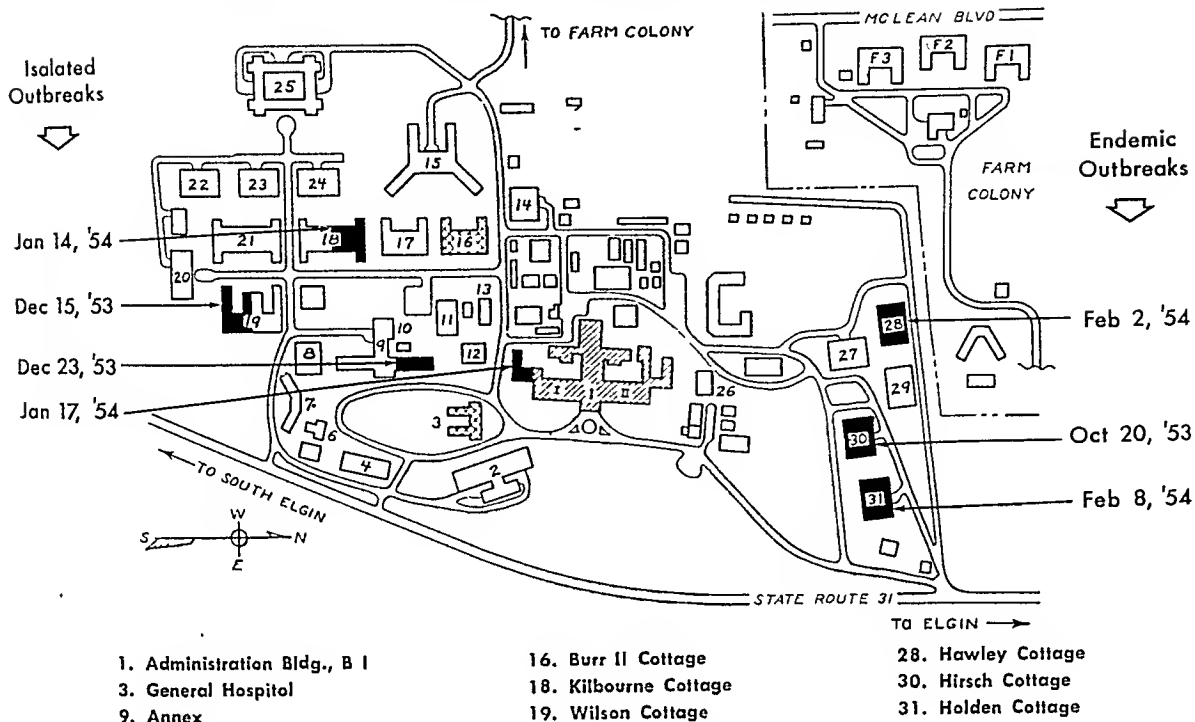
This question was presented to the court by a request for a declaratory judgment on the constitutionality of a proposed bill governing the commitment of the mentally ill. In a prior decision, *Appeal of Sleeper*, 87 A. 2d 115, this court held that where, as here, the temporary confinement is not ancillary to the institution of judicial proceedings the law requires that the person hospitalized be given an opportunity to institute judicial proceedings to test the necessity of his confinement and that this need is not satisfied by the availability of the writ of habeas corpus.

In the present case, the proposed bill adopted the language of section 17 of the Draft Act

Governing Hospitalization of the Mentally Ill (Public Health Service Publication No. 51). It provides that a patient who applies for his release shall be released within 48 hours unless the superintendent of the hospital certifies to a court of proper jurisdiction that in his opinion such release would be unsafe to the patient or others. In this case the patient may be detained for the length of time, not exceeding 5 days, necessary to institute judicial commitment proceedings.

Assuming, as this court apparently did, that the "temporary" 35-day commitment involved in this case must meet the same due process requirements as an indefinite hospitalization by medical certification, the court appears to have taken a different view than that adopted by the Supreme Court of Missouri in *Missouri ex rel. Fuller v. Mullinax*, 269 S. W. 2d 72 (Public Health Reports, October 1954, p. 982). That decision declared that such indefinite hospitalization without an opportunity for prior judicial proceedings was unconstitutional despite the presence of the remedies provided for by section 17 of the Draft Act.

Figure 1. Patient residences at Elgin State Hospital, Illinois.



sea, and diarrhea. Jaundice was observed in about one-third of the cases. All contacts, residents as well as employees in wards housing patients with infectious hepatitis, were given screening tests, including cephalin flocculation and urine urobilinogen. Residents exhibiting suspicious clinical or laboratory findings of the infection were sent to bed for observation pending confirmation of the diagnosis.

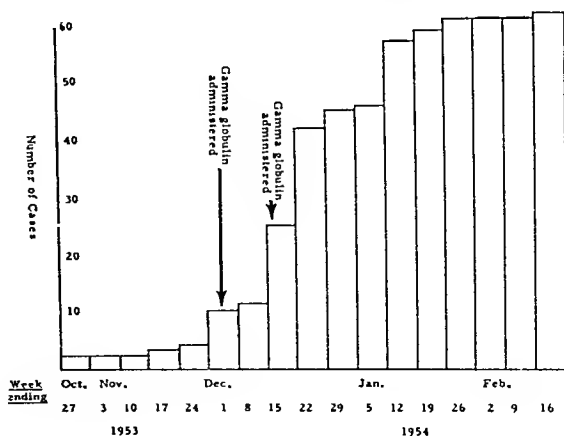
On discovery, the patients with infectious hepatitis were isolated and the affected cottages were quarantined. With the exception of the administration of gamma globulin and achromycin and special regimens for the acutely ill, the treatment and control measures were similar at the isolation units.

Preventive measures included separate garbage disposal and linen pickup. Food was served on disposable paper dishes. The basic treatment plan was relatively simple. It consisted of strict bed rest, a diet high in proteins and carbohydrates and low in fat content, a daily subcutaneous injection of 100 mg. of vitamin B<sub>1</sub>, and intravenous injection of isotonic fluids when there were indications of dehydration.

For Hawley and Holden hepatitis patients, an isolation unit was established at Hawley Cottage. The mounting number of Hirsch patients required various arrangements for their isolation and care.

Shortly after the discovery of the first two cases at Hirsch on October 20, a special isolation unit was set up within the cottage, and the cottage was placed under modified quarantine.

Figure 2. Distribution of infectious hepatitis cases at Hirsch Cottage.



(fig. 2). The rated bed capacity is 83 patients per unit.

Holden Cottage, adjacent to Hirsch, had the second highest attack rate, 8.7 percent. From February 8 to March 15, 1954, 17 cases occurred among 194 aged, ambulatory, deteriorated women patients. The rated bed capacity of this cottage is 96 patients.

At Hawley Cottage, separated from Hirsch by cottages and grounds, 16 infectious hepatitis cases were observed from February 2 through February 20, 1954. These cases involved 6.5 percent of the 244 generally elderly and disturbed patients in the cottage. Like Hirsch the rated bed capacity is 83 patients per unit. Figure 3 shows the distribution of cases at Holden and Hawley.

Single cases occurred at Wilson Cottage December 15, 1953, and the annex, December 23. Two cases occurred at Kilbourne Cottage January 14, 1954, and one case at B I, a ward in the administration building, January 17.

No infectious hepatitis was found in any of the hospital employees or any of their family members. Approximately 1,000 employees working on a 7-day 3-shift schedule look after the welfare of the patients. The personnel live on the grounds, in the city of Elgin, or in the surrounding area. They were permitted to circulate freely on the grounds and in the town.

The employee experience at Elgin varies from that noted by Capps and associates (2) in an orphanage for children under 3 years of age. Over a period of 8 years, 72 student nurses and 3 other adults contracted infectious hepatitis from the children. Outbreaks were ultimately eliminated by emphasis on aseptic nursing techniques.

### Epidemiological Investigation

Upon recognition of the epidemic an immediate, diligent investigation was made to discover the mode of transmission. The propagation of the infection by a common vehicle was considered, but so far as could be determined the water, food, and milk supplies were not contaminated. The results of all standard bacteriological tests were within the accepted normal limits. All plumbing fixtures are equipped with backflow preventers, and there was no back stoppage in

the sewage disposal systems on the involved wards. Furthermore, only 7 of the 26 cottages using the common water supply and sewage disposal system at the institution experienced an outbreak. The individual syringe technique is practiced throughout the institution in the immunization program.

Although no cases were observed among the employees, the possibility that they might harbor the virus and unwittingly spread the infection was always considered. Employee practice of proper hygiene, particularly frequent handwashing, was stressed as a precautionary measure both for themselves and their patients.

Despite investigation and followup, the exact vehicle of contamination or mode of transmission was never ascertained. While the habits and practices of the patients lend credence to the fecal-oral route, suggested by Lilienfeld and others (3) as the general mode of transmission, the relatively confined area of the spread of attack, in the absence of contradictory evidence, points to a carrier as the most likely source of origin.

### Diagnosis and Management

It is generally conceded, that although mortality from infectious hepatitis is low, its protracted convalescent period and possible liver

Age and sex distribution of infectious hepatitis patients, Elgin (Ill.) State Hospital

Age (years)	Women	Men	Total
20-30	10	0	10
31-40	22	2	24
41-50	21	3	24
51-60	16	0	16
61-70	12	0	12
71-80	11	0	11
81-90	3	0	3
Total	95	5	100

damage, particularly in adults, warrants careful and extended followup and treatment in the early stages if serious after-effects are to be avoided.

The outstanding and most common clinical symptoms among the hepatitis patients were fatigue, listlessness, headaches, anorexia, nau-

oped subsequently among patients thus treated, the last one on February 13, 1954. They occurred the following dates:

<i>Date</i>	<i>Cases</i>
Dec. 15-31, 1953-----	21
Jan. 1-14, 1954-----	11
Jan. 15-31, 1954-----	4
Feb. 1-13, 1954-----	1

No gamma globulin was administered to any of the Hawley or Holden residents. But the Hawley patients with infectious hepatitis received 2 grams of achromycin daily for 5 days, while the other residents received a prophylactic dosage of 1 gram of achromycin daily for 10 days. None of the Holden residents received achromycin.

The 171 noninfected residents at the Wilson and annex units were given 5 cc. of gamma globulin. No further outbreaks were reported at either location.

Neither gamma globulin nor achromycin was administered to the residents of Kilbourne and of the affected wing of the administration building. No new cases were noted at these locations.

### Psychiatric Improvements

One of the outstanding developments noted in the course of the epidemic was a marked psychiatric improvement among patients in isolation wards. Similar improvement was reported by Galioni and associates (5) in a study under comparable conditions. While on isolation status, the patients enjoyed greater personal attention than they ordinarily received in the overcrowded units.

Patients who had been in need of toilet training or had been untidy and preoccupied with their excretions prior to their transfer to the isolation units often conquered these shortcomings within 48 hours. Many who had been mute and uncommunicative and were unable to verbalize attempted to make their wishes known to attending personnel within 3 to 5 days after arrival. Many months of intensive psychotherapy would have been required to achieve a similar reaction.

This transient improvement was emphasized by the relapse of the patients into their former condition when special attention and personnel

were withdrawn on the return of the patients to their original wards.

On the other hand, no further mental deterioration was noted in the patients during or following the disease, even among the senile group, although such sequelae were reported by Noyes (6).

### Summary and Conclusions

During the fall and winter of 1953-54, 100 cases of infectious hepatitis in adult mental patients were observed and treated at the Elgin (Ill.) State Hospital.

The highest incidence of cases, 98 out of 100, appeared in cottages housing the more deteriorated and untidy patients; 62 were discovered in a residence for severely regressed women possessing poor personal hygienic habits and living under grossly overcrowded conditions.

No uniform pattern of attack could be determined such as appearance of groups of cases at periodic intervals.

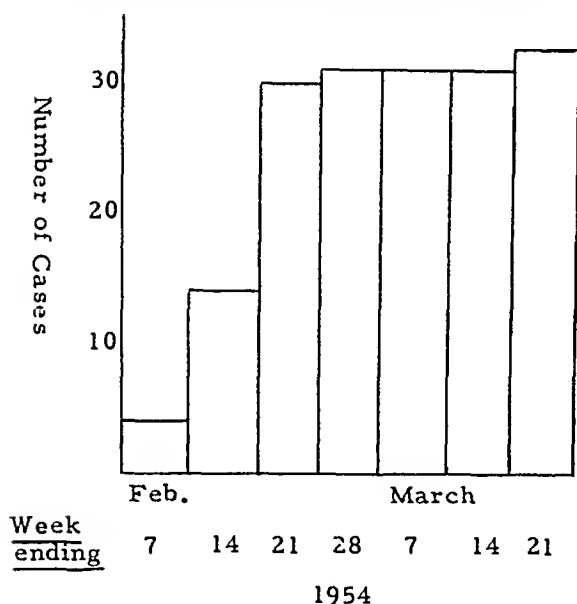
The lack of incidence among hospital employees caring for the patients was ascribed to high standards of personal hygiene and sanitation among the personnel.

The vehicle of contamination or mode of transmission was never ascertained, although exhaustive and continued investigation excluded, we believe, the water and food supplies and the sewage disposal system as the source. The fecal-oral route is suspected, but the area of spread also points to person-to-person contact with a carrier as a likely mode of transmission.

Marked psychiatric improvement was observed among patients transferred from overcrowded wards to isolation units or convalescent centers where they received greater individual attention and consideration. The gains were lost on return to their regular quarters.

The success reported with the use of gamma globulin in the early exposure stage during similar epidemics was not duplicated at Elgin Hospital. Thirty-seven cases developed at Hirsch Cottage during a period of 61 days following inoculation. Equivalent cessation of the secondary attack rate was experienced at Hawley and Holden where no gamma globulin was given. No spread of the disease occurred at the units housing the sporadic cases regardless

**Figure 3. Distribution of infectious hepatitis cases at Hawley and Holden Cottages.**



Patients were not permitted visitors from inside or outside the institution grounds, nor were they permitted to leave the cottage.

After December 1, 1953, when 10 Hirsch residents had developed the disease, all the sick patients were transferred to the institution's acute disease hospital.

By December 15, when the Hirsch cases totaled 25, the limited facilities of the acute disease hospital were severely taxed, and the infectious hepatitis cases constituted a possible hazard to the other hospitalized patients. A special isolation unit for Hirsch hepatitis patients was set up in Burr II Cottage, an infirmary for women on the south side of the grounds.

The Burr isolation ward was created by subdividing 1 of the 2 dormitories. The entire cottage, with an average of 193 patients, was quarantined.

On January 14, 1954, the Hirsch patients, 57 by this time, were returned to Hirsch Cottage, which continued under quarantine. Attending nursing personnel moved with the patients, and a special unit designated for recuperation purposes functioned until April 18, 1954.

On arrival at the Burr isolation unit, the majority of the patients exhibited mild symptoms of infectious hepatitis—diarrhea and

vomiting which stopped in a few days. Several had a moderate degree of liver enlargement.

Ten patients were seriously ill upon arrival. They developed temperatures ranging up to 104° F., severe jaundice, diarrhea, and vomiting, icterus indexes up to 10, and cephalin flocculation tests of 4-plus intensity.

Treatment of the 10 severely ill patients was supplemented by 500 mg. of aureomycin administered four times a day. Five percent glucose in saline infusions, together with vitamins B and C, were given when indicated.

Five of these patients, who exhibited low blood pressure, experienced decompensation of the cardiovascular system. They received supportive therapy in the form of digitalis, coramine, and caffeine.

One patient developed severe bilateral parotitis, in all probability caused by inadequate oral hygiene. One epileptic in this group continued to receive anticonvulsant medication in the form of dilantin-sodium and luminal, 1½ grains of each three times daily.

Three of the acutely ill Hirsch patients died. For none of these, however, did the clinical records indicate infectious hepatitis to be the primary cause of death. Three deaths were also reported from the Hawley isolation unit, 2 of patients more than 80 years old and the other 75. Here again, there was no indication in the records that infectious hepatitis was a factor in the deaths.

### Gamma Globulin

Other workers (4) have reported that gamma globulin administered during infectious hepatitis epidemics has provided a high degree of protection to exposed persons.

As a preventive measure at Hirsch Cottage, 5 cc. of gamma globulin was administered to each noninfected resident on December 1, 1953. Personnel working at Hirsch (and later at the other affected cottages) were offered the same dosage on a voluntary basis, with most of them consenting to the injection.

On December 14, the remaining 242 noninfected patients at Hirsch and the employees received another 5 cc. of gamma globulin.

This attempt to control the epidemic was only moderately successful since 37 new cases devel-

oped subsequently among patients thus treated, the last one on February 13, 1954. They occurred the following dates:

Date	Cases
Dec. 15-31, 1953.....	21
Jan. 1-14, 1954.....	11
Jan. 15-31, 1954.....	4
Feb. 1-13, 1954.....	1

No gamma globulin was administered to any of the Hawley or Holden residents. But the Hawley patients with infectious hepatitis received 2 grams of achromycin daily for 5 days, while the other residents received a prophylactic dosage of 1 gram of achromycin daily for 10 days. None of the Holden residents received achromycin.

The 171 noninfected residents at the Wilson and annex units were given 5 cc. of gamma globulin. No further outbreaks were reported at either location.

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of gamma globulin administration. Possibly this agent is not as efficacious for deteriorated mental patients possessing low standards of sanitation as for other groups.

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# A Patients' Opinion Survey at Firland Sanatorium

By CATHERINE E. VAVRA, R.N., M.P.H.,  
and EDITH DYER RAINBOTH



U. S. Navy photograph

WHEN Firland Sanatorium wished to find out the patients' opinions about their care and treatment so that it could make changes which would lead to greater satisfaction, it was evidence of a realization that the psychological reactions of patients affect their recovery. It also indicated the willingness of the hospital staff to see themselves through the eyes of the patient.

Some of what the staff saw pleased them very

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*Miss Vavra, assistant professor, department of public health and preventive medicine, University of Washington School of Medicine, was formerly director of the health education division, Tuberculosis and Health Society of Wayne County, Mich., and instructor in nursing, University of Minnesota School of Public Health.*

*Miss Vavra's first report on the Firland survey appeared in the American Journal of Public Health, September 1952. The present report is based on her paper for the annual meeting of the Western Branch, American Public Health Association, April 20, 1955, in Phoenix. The full report (181 pages) has recently been published and may be obtained from the Anti-Tuberculosis League of King County, Wash.*

*Mrs. Rainboth, co-author of the full report of this study, is assistant director of the Washington Public Opinion Laboratory, University of Washington.*

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much, but some of what they learned gave them insight which resulted in administrative changes in personnel, improved ways of counseling patients and assigning the nursing staff, better arrangements for good housekeeping, and specific modifications for the patients' comfort.

## The Hospital Setting

Firland Sanatorium, the King County (Wash.) hospital, had moved to its present location on the north side of Seattle about 4 years before we undertook a patient opinion survey in May 1951. The new location had formerly been occupied by the Seattle Naval Hospital. After the move, the sanatorium had met the usual problems of expansion from a 400-bed unit to one of 1,300 beds, housed in 54 buildings on 160 acres of ground. Twenty-one physicians and 115 registered nurses were working full time in an administrative plant of 5 medical services, each service headed by a medical chief. The hospital was handicapped by the shortage of graduate nurses.

The medical and nursing staffs are assisted by social workers, occupational therapists, dietitians, vocational counselors, teachers, a dentist, and dental technicians. Other employees include practical nurses, nurse aides, food-service and housekeeping personnel, janitors, orderlies, and so forth, bringing the aver-

age number of employees to about 916 at the time of the survey.

Firland is fortunate in having more than adequate recreation facilities. Ambulatory patients have access to a lounge, an auditorium, a workshop, library, poolroom, music practice room, greenhouse, modern kitchen (for teaching work simplification and energy conservation), printing press, and television programs.

Movies and a patient-operated store are the most popular ways of passing time for patients having limited activity status. Mail is taken to the wards every day from a branch post office at the hospital. The large grounds and numerous pathways encourage the enjoyment of picnics and walks. A central intercommunication system and earphones or pillowphones bring the pleasure of music and entertainment programs to the bedridden. Up-patients wheel magazine carts to the patients in bed and contribute to their happiness in many ways. Many patients have their own radio or television set.

A patients' council representing the wards meets with the hospital staff to work out solutions to any grievances. Weekly broadcasts by the medical director and the reading of the hospital bulletin over the intercom help supplement the personal contacts of the professional staff and patients. Each newcomer on admission receives a pamphlet, "Welcome to Firland," explaining the rules of the hospital. Four teachers work with patients taking elementary or high school courses through an arrangement with the Seattle public schools. Religious counseling is always available, and services are held once a week or more often.

Each patient is assigned to one of the five medical services, where he usually remains from the time of admission except for temporary assignment to a surgical unit when necessary. It is hoped that this procedure gives him a feeling of continuity in his treatment and contributes to his personal relationship with his physician.

### The Hospital Patients

At the time of the study (May 1951) the patient census was 1,137. The supervising nurses reported that 198 patients were ineligible for the study because they were too ill, too young, or had language difficulty, or were absent be-

cause of town leave or treatment. Of the 939 eligible patients, 91.3 percent (857 patients) completed their questionnaires.

The patient population studied (857 patients) was 60 percent male and 40 percent female. Ages ranged from 15 to 91 years. Forty percent of the men were under 40 years of age, while 75 percent of the women were in this age category. Thirty-six was the median age of all patients. Half (48.9 percent) of the women were single, widowed, divorced, or separated, but two-thirds (67.5 percent) of the men were in this category of the unmarried.

The median year of school completed by patients 25 years old and older was 11 (10.7) years, a little lower than the amount of schooling (median year 12.1) completed by Seattle residents. Twenty-seven percent had finished high school. An additional 20 percent had some college education.

Admission to Firland was the first admission to any tuberculosis hospital for 68 percent of our patients. Twenty-five percent had been here for less than 6 months, another 25 percent for 24 months or more. Eight percent had relatives who were also patients in a tuberculosis hospital. Approximately two-thirds of the patients were restricted to bed rest. Some lonely individuals (7.4 percent) never had any callers, but almost two-thirds (61.6 percent) of the patients had visitors once a week or more frequently.

Three hundred five of the participating patients were in private rooms, and the remaining 552 were in wards of approximately 66 beds each.

### Need for the Study

Studies similar in purpose to our study at Firland have been made in recent years to ascertain whether patients were satisfied with the hospital care they were experiencing (1-4). Concern as to why patients leave the hospital against medical advice has led to studies of the reasons they give for not remaining until their discharge is recommended. Concern over irregular discharges was the basic reason for the Firland study.

In 1950, 44 percent (299) of all live discharges at Firland were against medical advice.

At first glance this rate appears to be high, but undoubtedly it is affected by the sanatorium's high standard of medical discharge. A patient had to demonstrate the stability of his tuberculosis over a minimum of 3 months by 7 or more hours of daily activity.

The challenge of reducing the number of irregular discharges, reactivations of the disease, and the resulting readmissions prompted the medical director and the business manager of Firland Sanatorium to initiate the patient opinion survey. By having all hospital staff members become more aware of the factors in total patient care which contribute to satisfaction and dissatisfaction, they hoped to encourage the staff to modify any practices which might hamper wholehearted cooperation with the prescribed treatment.

The purpose of this study was to obtain useful information in the operating situation. It might be described as action research in an applied setting. By obtaining patients' responses to a large number of questions, some of which were open-end, free response types of questions, we hoped to obtain information which might provide a somewhat better basis for administrative planning. No claim is made that this study is basic research of the real attitudes and beliefs of our patients. However, we feel that this type of action research did tend to point up some specific areas of satisfaction and dissatisfaction which might have some real meaning for all institutions concerned with long-term care.

### Conducting the Study

The methodology of our study contains these six features which helped increase its effectiveness:

1. The cooperation of the patients' council in wording the questions, in pretesting the questionnaire for clarity and ease of administration, and in distributing and collecting responses.
2. The use of both open-end and closed-end types of questions.
3. The patients' rating of hospital personnel on 10 designated personal traits such as "interested in you," "know their jobs," "friendly," and so forth.
4. The establishment, independent of the survey, by the staff members themselves of their

own qualitative standard of performance on key questions.

5. The staff's assistance in deciding on the questions to be asked.

6. The appointment of a hospital coordinating committee to plan staff and patient participation and to help interpret the data being collected.

The coordinating committee represented each of the professional disciplines in the hospital. It included the chief of one of the medical services and a consulting psychiatrist from the University of Washington Medical School, a representative from the Washington State Division of Vocational Rehabilitation, as well as the two authors of the survey, who represented the Department of Public Health and Preventive Medicine and the Washington Public Opinion Laboratory, University of Washington. The committee met once a month.

The medical director of the hospital sent a friendly letter to all patients, explaining the purpose of the study and telling them to consider the questionnaire as an opportunity to give their opinions in confidence without signing their names.

The 857 respondents answered 105 write-in, yes-or-no, and multiple-choice questions. Altogether there were some 140,000 coded answers, which the statistical division of the Seattle-King County (Wash.) Department of Public Health helped tabulate. The patients' comments about things liked and disliked added much useful information. The content analysis of the written comments was time consuming and delayed completion of the study, but these responses gave us the best insight as to how patients really felt about their hospital experience. The analysis of the study was completed in November 1954.

### Responses to the Questions

The survey attempted to elicit from every patient his opinion about almost every phase of hospital experience, including his understanding of the ways in which the staff members were working toward his recovery. Questions were asked about such items as knowledge of the disease, medical treatment, nursing service, food, routines of care, physical environ-

# Firland Sanatorium Rating Worksheet for Key Questions

(Seven sample questions)

To Staff Member: The purpose of these ratings is to establish criteria by which to interpret the responses of patients to selected questions in the patients' attitude survey. For each question below, fill in your best estimate of the percentage response that you would rate as a "poor" response and the percentages you would rate as "fair," "just acceptable," "good," and "very good" responses.

Key questions	What percentage response would you rate as—				
	Poor?	Fair?	Just acceptable?	Good?	Very good?
Do you think this hospital is run with your welfare at heart? Percent answering "Yes"-----	Less than --%	--% through --%	--% through --%	--% through --%	--% or more.
Do you feel this treatment here is helping you? Percent answering "Yes"-----	Less than --%	--% through --%	--% through --%	--% through --%	--% or more.
Is there much unnecessary delay in getting a report about your X-ray and lab tests? Percent answering "Seldom or never."	Less than --%	--% through --%	--% through --%	--% through --%	--% or more.
Do you feel you are getting good care? Percent answering "Excellent or very good."	Less than --%	--% through --%	--% through --%	--% through --%	--% or more.
Are your physical complaints (like headaches, etc.) taken care of satisfactorily? Percent answering "Always or often."	Less than --%	--% through --%	--% through --%	--% through --%	--% or more.
In general, do you think you get the nursing care you need? Percent answering "Always or mostly."	Less than --%	--% through --%	--% through --%	--% through --%	--% or more.
How often does your doctor have private talks with you? Percent answering "As often as necessary."	Less than --%	--% through --%	--% through --%	--% through --%	--% or more.

ment, patients' council, rating of traits of personnel with whom they came in contact, and special services such as occupational therapy, vocational counseling, and social service.

The patients rated high the skills and technical knowledge of the staff. They evidenced understanding of the communicable aspects of tuberculosis and of the importance of bed rest in its treatment. They admitted the inability to adjust to bed rest and indicated the extent of the inability. They revealed a lack of understanding of the functions of the medical social worker. They indicated that their chief worry was about plans for the future.

Patients tempered their criticisms of unsatisfactory experiences in the hospital with praise of other, highly satisfactory experiences. They

chose words expressing very high satisfaction or very low satisfaction when commenting about members of the hospital staff who did or did not show understanding of their problems or who did or did not treat them as individuals. Their comments and responses indicated concern about their need for more private talks with their physicians and expressed anxiety regarding delays in getting X-ray and laboratory reports.

Ninety percent rated Firland as a good hospital or one of the best tuberculosis hospitals. Only 10 percent rated their care as fair or poor. We were pleased to learn that 89 percent said that their families believed they were in the best place for care while they had tuberculosis.

Here are two examples of the closed-end ques-

tions we used and the percentage responses tabulated. In these questions, as in the other tabulations reported, the percentages mentioned are derived in each instance from the number of patients answering the questions:

*Are you told ahead of time what changes there will be in your treatment?*

	Percent
Always.....	35.5
Often .....	27.4
Now and then.....	18.1
Seldom.....	9.5
Never .....	9.5

*Are your physical complaints (like headaches) taken care of satisfactorily?*

	Percent
Always .....	51.9
Often .....	21.2
Now and then.....	18.3
Seldom.....	5.4
Never .....	3.2

Although 95 percent answering one of the closed-end questions indicated that a tuberculosis hospital was the place to go for treatment as well as to protect others from tuberculosis, only 61 percent in response to an open-end question about ways to prevent tuberculosis wrote clear-cut statements with correct answers such as: "Stay away from others, isolate the sick person." In another closed-end question indicating the degree of understanding about tuberculosis, 95 percent said it is possible to feel well and still have tuberculosis. In still another, only 86 percent recognized that tuberculosis does not always give warning in its early stages.

Comments written in by the patients covered a wide variety of topics. In the full report of the study, analysis of these comments are reported in detail (5). However some selected comments regarding the survey, the hospital, and care are as follows:

"This (meaning the survey) is the finest thing that has been done."

"If you would do more of this, we'd like it."

"This is a wonderful hospital—thanks for everything."

"The staff works out treatment in a fine way, but I believe the mental outlook of the patient is left entirely to chance."

"Good care—indifferent attitude—they feel

we are a pair of lungs in bed with absolutely no feelings whatsoever. Treatment and care conform too closely to an assembly line process."

"Care is excellent—personnel take sincere interest in my feelings and my care."

"My doctor always stops to report any news on tests and my condition and to check on how everything is going."

"I can understand that our doctors are too overworked to take time to explain, but that doesn't solve my problem of wanting to know about the progress or retrogression of my case. Wish something could be done about this."

"I know the nurses are busy, but can't we have better service at night?"

"Shortage of help makes us rush our routines until we are exhausted."

"Why can't we have our pajama tops ironed?"

"Try to get more movies—at least once a week."

## Standards of Performance

Since we had no other study with which to compare the patients' reactions to their care, and yet we wished to make some kind of qualitative judgment about their responses, we asked some of the professional staff—mostly physicians, supervisory nurses, dietitians, and social workers—to experiment with us, establishing their own standards of performance in terms of patients' responses.

The staff selected 27 key questions which they thought would best reflect the patients' reactions to the care, treatment, and service the patient received from the professional and housekeeping staffs at the sanatorium. Next, the staff estimated on rating worksheets (see sample) the percentage of favorable replies which they thought would be evidence of poor, fair, just acceptable, good, or very good performance on their part. In this fashion, physicians, nurses, and some of the other members of the staff worked out estimated standards of performance for themselves as a group by a majority vote of the percentages they considered acceptable for each category.

The hospital coordinating committee selected the estimated percentage in the "good" category as the qualitative standard for each key question. Then for each key question, we compared

the actual percentage of favorable responses given by the patients with the estimated standard agreed upon by the majority of the staff as indicating "good" performance on their part. We also tabulated responses by wards so that the staff could see how their own wards performed.

"Do you know what the social worker can do for you?" a key question, is an example of how the actual responses compared with the estimated standard of good performance the social workers had set for themselves.

Percentage of patients checking "Yes," they knew what the social worker could do for them----- 48  
Estimated standard of "good" performance----- 60

The social workers had estimated that a percentage response of 60 percent would indicate

**Table 1. To the question, "How often does your doctor have private talks with you?" 423 patients (out of 749 answering the question) indicated by their written responses that they had private talks as often as necessary**

Ward	Number of patients answering question	Respondents indicating that they had private talks as often as necessary	
		Number	Percent <sup>1</sup>
All wards-----	749	423	56
32-----	23	19	83
40-----	11	9	82
3-----	24	19	79
51-----	41	31	76
4-----	36	26	72
55-----	38	24	63
2-----	24	15	62
5-----	40	25	62
15-----	32	20	62
33-----	29	17	59
52-----	27	16	59
1-----	16	9	56
44-----	18	10	56
31-----	29	16	55
53-----	58	32	55
11-----	45	23	51
12-----	30	15	50
54-----	40	20	50
14-----	46	21	46
6-----	7	3	43
34-----	42	18	43
43-----	19	8	42
30-----	46	18	39
10-----	23	8	35
41-----	5	1	20

<sup>1</sup> Percentages are based on the number of patients answering the question in each ward.

a "good" standard of performance on the part of the social service staff.

Replies to the question, "Is there much unnecessary delay in getting a report from your X-ray and laboratory tests?" pointed up an area of dissatisfaction.

Percentage of patients checking "Seldom or never any unnecessary delay"----- 55  
Estimated standard of "good" performance----- 75

The physicians had estimated that if 75 percent answered the question favorably, they (the physicians) would consider this evidence of "good" performance on their part. As it was, the replies showed that only 55 percent thought there was seldom or never any delay in getting reports. Only one ward met the physicians' standard in this respect, and written-in comments by the patients indicated their anxiety about delays in reports of X-ray and laboratory tests.

One of the questions which produced changes in administrative planning related to the satisfaction of having private talks with the doctors. When written-in responses to the question (table 1) were analyzed and tabulated by wards, we saw that the estimated standard was being met in only five wards. The overall responses showed that 56 percent of the patients felt they had private talks as often as necessary, but a 70-percent response had been agreed on as the estimated standard of good performance for physicians.

### To Lessen Dissatisfaction

Of course, the reactions of the physicians varied. Some tended to belittle the significance of the study, saying that the criticisms didn't mean much, that the dissatisfied were probably influenced by some extenuating factor such as a neurosis or alcoholism. They called attention to the fact that 29 percent of the 299 irregular discharges in 1950 were classed as alcoholics.

Most of the physicians agreed, however, that the results of the survey reflected patient discontent in some measure and that the various criticisms should be answered by constructive changes in administrative procedures, and by serious consideration of the psychological factors which may be involved in the patients' reactions to certain administrative procedures.

The immediate problem was how to lessen discontent. To some it appeared that most of the areas of dissatisfaction could be eliminated by having the medical service institute a program of interviews for each patient in the doctors' conference room. The interview conference, they said, has been effective in teaching a patient about his own form of tuberculosis and about the disease in general.

The doctors proposed that the patient meet, shortly after admission and at frequent intervals thereafter, first with the chief of the service, the staff physician, resident physician, and then with the medical social worker, vocational counselor, chaplain, and any others on the staff, including nursing students, who might be able to help him understand his own case.

The patient's doctor would start the first conference by holding up the chest X-ray, explaining it in detail, pointing to the location of the disease, indicating the cavity, and so on. By encouraging inquiry about the implications of his own case, questions about the therapy—whether drugs and bed rest alone would control the disease or whether surgery might be necessary—the patient would be drawn into discussing his home problems, his future plans, his welfare. The hoped for result would be a gain in understanding for everyone.

The interview sessions have now been in effect

for 4 years. The program has been valuable in the day-to-day management of the patient. It supplies much of what each person in a tuberculosis sanatorium craves—a climate of helpfulness, a form of reassurance, and practical education about his specific form of the disease.

At present, the doctors' offices have been moved near the wards so that the doctors may have X-rays and charts close at hand and will be able to see patients every day if necessary. The change involved a reorganization in the filing arrangements and in the use of the clerical staff. It has made for a closer working relationship with the nursing staff on the wards.

### Rating of Personal Traits

Our survey questionnaire gave every patient a chance to say whether he thought the doctors and others on the staff were uninterested or interested in his individual welfare. As a group, doctors, head nurses, nurses, orderlies and nurse aides, pantry maids, and ward maids and janitors were assessed by the patients in a 3-way rating of 10 personal qualities checked by each respondent. For example, for the trait "interested in you," the patient could check "often," "now and then," or "seldom" for each staff group. As with the standards of performance set for the 27 key questions, 7 of the personal

Table 2. Doctors and nurses as Firland patients saw them, percentage response, 1951 study

Quality	Doctors			Nurses		
	Often	Now and then	Seldom	Often	Now and then	Seldom
<i>Positive</i>						
Know their job.....	92	7	1	78	19	3
Try to get you to take a good cure.....	86	8	6	71	16	13
Friendly.....	83	15	2	76	20	4
Willing to listen.....	79	16	5	72	20	8
Can remember them smiling.....	78	18	4	71	23	6
Interested in you.....	75	19	6	57	30	13
	Seldom	Now and then	Often	Seldom	Now and then	Often
<i>Negative</i>						
Crabby.....	87	12	1	74	22	4
Unreasonable.....	85	11	4	80	17	3
Bossy.....	81	13	6	71	20	9
Show favoritism.....	75	15	10	68	20	12

traits were chosen for measuring good performance on the part of medical, nursing, and housekeeping personnel.

The prevailing opinion of the patients as to the personal qualities of doctors and nurses is shown in table 2 by the percentage of patients responding. For example, 92 percent of the replies indicated that these patients thought the doctors knew their job and 78 percent thought the nurses knew their job. The quality "interested in you" rated the lowest response for all personnel and rated 75 and 57 percent, respectively, for the doctors and the nurses.

During the 4 years since the study was made, there has been a gradual weeding out of the nurses, nurse aides, and others who were showing little interest in the patients. Also there has been serious discussion among the medical staff and nursing personnel regarding the importance of having the patient realize that they are "interested in him as an individual."

To assist with the educational program for patients and staff, a full-time professional health educator has been employed as of February 1956.

### Some Other Improvements

Some of the changes in the hospital setting at Firland Sanatorium we attribute to the staff's seeing their own performance from the viewpoint of the patients, but there have been many other changes. Changes have been made in the administration of the nursing department, for which the orientation of all new staff members was revised. The nursing program has been adapted to the needs of different personnel on the staff. Some of the head nurses are assigned to smaller units to provide for better ward coverage, both during the day and at night.

All new employees and employees formerly assigned to night duty have an opportunity to work on the day shift. Classes in advanced procedures are held for selected groups of practical nurses assigned to evening duty, and review classes are held for practical nurses and orderlies. Additional assistant housekeepers have been employed in the housekeeping department to supervise the work of the janitors and maids. The laundry has benefited from

changes in personnel and from improved methods of handling lost articles. We now iron pajamas.

Changes made in the dietary department provide closer supervision of all foods checked out of the kitchen. Subordinate leaders are being developed from among the cooks, pantry workers, dishwashers, and counter girls. The relationship between the dietary department and the nursing and medical departments has been more clearly defined for ward personnel. On-the-job training is given to pantry girls for whom a special training manual has been developed also. Methods of keeping food hot, tasty, and attractive have been worked out and put into practice. We find we can serve coffee hot instead of lukewarm, a criticism that cropped up frequently among the questionnaire responses.

We now have movies every week.

It is not possible to recount all the changes that have resulted from the study. Some improvements no doubt would have come about because of the extensive use of chemotherapy in treating tuberculosis, reducing the average length of stay from 18 months to 8 months. Other improvements would have been expected from the staff's constant effort to lessen dissatisfaction and give the best possible care to each patient. We think we have made some progress in getting patients to feel that their physicians and nurses have a warm interest in their well-being, but such progress is hard to measure.

To whatever circumstance we attribute the changes, the discharges of patients against medical advice decreased from 44 percent of all live discharges in 1950 to 15 percent in 1954. To us this indicates that many of the factors causing dissatisfaction have been removed.

### A Supplementary Study

A second study to refine our questionnaire and to ascertain the current opinion of patients about their hospital experiences was made in June 1955. In this second study we have attempted to design a questionnaire which can be used periodically, and for practical purposes it has been limited to about 65 items. As the research team worked on this second survey, two of the problems on which they have concen-



trated are (a) the problem of having staff members show more interest in their patients and (b) the need for better communication between physicians and nurses and between professional staff and patients.

During the early planning stage of the second study the five medical chiefs of service and the supervisory nurses voted to become active members of the research team rather than just members of the hospital coordinating committee. This made for an even closer relationship with the hospital staff than during the earlier survey. A staff member of the Anti-Tuberculosis League of King County, which contributed funds for publishing the first report (5), also is a member of the committee.

The results of our 1951 study have shown that Firland personnel have accepted an action study of their own behavior—a survey which involved themselves in its plan, conduct, and interpretation. Their willingness to take action on the findings, plus their ability to work together as a research team with the technical consultants, is in itself an accomplishment. The willingness to repeat the survey indicates an acceptance of

research methods to get at an understanding of dissatisfaction.

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## Uterine Cancer Detection Studies

Eight cities have been selected for additional evaluation studies of the exfoliative cytology technique for detecting uterine cancer: Louisville, Ky.; Madison, Wis.; Detroit, Mich.; Charlotte, N. C.; San Diego, Calif.; Providence, R. I.; Columbus, Ohio; and Washington, D. C. Preliminary evaluation of the technique was conducted in Memphis, Tenn.

The new projects will begin as soon as arrangements are completed with sponsoring or cooperating local health and medical agencies, and each will continue for about 3 years. In some localities, the National Cancer Institute of the Public Health Service, will staff and equip local clinics and agencies; in others, grants will be made to support work that will be carried out entirely under local auspices.

A report of the study in Tennessee was presented in the April 1955 issue of *Public Health Reports*, p. 341.



# Sanitation of Domestic Airlines

By WILLIAM H. MEGONNELL, M.S., and HOWARD W. CHAPMAN, B.S.C.E., M.P.H.

**C**OMMERCIAL AIRLINES of the United States have achieved a notable degree of progress in cleanliness and sanitation.

Today's air passenger is provided many more comforts than were available in earlier aircraft. Airline companies properly insist that practicable passenger conveniences unquestionably contribute to the continued success of air

transportation. However, the installation of water systems, toilets, and galley facilities, such as are found on railway cars and ocean-going vessels (1, 2), is necessarily adjusted to the primary considerations of safety of the passengers and crew and weight and space conservation in all phases of airline operation.

The domestic scheduled airlines carried more than 32 million passengers in excess of 16 billion passenger-miles during 1954 (3). There was a tenfold increase in the number of passengers carried and the passenger-miles flown in the short span between 1942 and 1954. Nineteen scheduled lines operated 186 aircraft in 1942. Twelve years later there were 32 lines with 1,175 craft. Comparable figures are not available for nonscheduled lines, but their growth probably paralleled that experienced by the regular airlines.

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*Mr. Megonnell, at present doing graduate work in public health at Harvard University, is a sanitary engineer in the Division of Sanitary Engineering Services, Public Health Service. He is co-author, with E. C. Garthe, of Dining Car Sanitation in the United States, published in the January 1955 issue of Public Health Reports (p. 25).*

*Mr. Chapman is co-author, also with Mr. Garthe, of Sanitation Aboard American Flag Vessels, which was published in October 1952 (p. 963), and was the first of the articles on the carrier-inspection functions of the Public Health Service. Mr. Chapman is Public Health Service regional engineer for Region IV (Atlanta).*

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## Public Health Significance

All parts of the world can now be reached by air within the incubation period of the major infectious diseases.

Obviously, the rapid development of long-range air transportation is a source of much concern to public health authorities. It is the Federal Government's responsibility to institute protective measures aimed at preventing the introduction, transmission, or spread of communicable diseases from foreign countries to the United States, and in this country, from one State to another. When the Congress granted interstate quarantine authority to the Public Health Service in 1893 (4), however, only balloonists traveled by air.

The Service devoted little attention to the matter of airline sanitation until the early 1940's. In wartime, as swift transportation became vital to national survival, servicemen and defense workers took to the air in unprecedented numbers. To provide public health workers and carrier employees with necessary information and guidance in conforming to the Interstate Quarantine Regulations (5), the Service in 1942 published the Sanitation Manual for Land and Air Conveyances Operating in Interstate Traffic (6). Limited association with the airline industry up to that time and relatively long experience in railroad sanitation made it inevitable that the Service base the manual largely on land-carrier operations.

Before the war, the largest commercial airliner seated 21 passengers. The longest flight was approximately 800 miles and required about 4½ hours of flying time. After the war, the commercial airlines converted a number of military aircraft into passenger planes, designed to carry from 40 to 50 passengers on flights of several thousand miles. Subsequently, faster planes with additional passenger capacity were built.

The use of larger and faster conveyances results in two important factors of public health significance: (a) The carrying capacity creates in proportion the need for food, water, and beverage containers, wash water tanks, and toilet facilities, and (b) speed and flight range shorten the travel time between endemic disease areas and areas susceptible to infection. Airline personnel were applying to their sanitation problems the ingenuity typical of the industry, but there was little or no standardization of equipment or uniformity of operation among the carriers. The possibilities of disease transmission

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## That Ridiculous Pork Chop

"I had a pork chop at a height of 8 miles above the earth's surface. . . . Find yourself slipping through space in a comfortable armchair at just under 500 miles per hour, your hat in the rack above your head and the nearest point of the earth's surface some 40,000 feet below you; it is hard to think of anything that could make you more acutely sensible of your singular situation. But a pork chop does it. Sizzling hot from the galley they brought it to me, and I looked at its homely outline and then out along the steady, silver wing into the deep blue dome of the sky, and I thought of the pitiless sub-sub-zero unbreathable air in which we hung and the long, long drop below—and then I looked back at my plate again and somehow, suddenly, the whole sweep and sublimity of man's miraculous achievements seemed to be summed up and crystallized in that ridiculous chop. What business had such a thing to be 8 miles up in the air? . . . It tasted—and I remember being surprised at that, too—much as usual."

—From H. F. ELLIS, *Meals in Motion*,  
*The Atlantic*, August 1954, pp. 93-95.

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together with the growth of the air transport industry made apparent the need for a comprehensive handbook devoted exclusively to standards of interstate airline sanitation.

To meet this need, the Service published the Handbook on Sanitation of Airlines in 1952 (7). The Joint Committee on Airline Sanitation, a committee composed of caterers and representatives of the airlines associated with the Air Transport Association of America, collaborated closely with the Service in the preparation of the text. Representatives of other airlines and many State health departments reviewed the preliminary draft.

The publication sets standards on all facets of interstate airline sanitation for domestic air carriers. United States airlines operating in foreign traffic follow the same standards, whenever practicable, in their overseas operations.

The handbook is intended for the use of designers, builders, caterers, and servicing area personnel as well as operators of aircraft. Some day it may serve to stimulate the formu-

lation of comprehensive international standards since sanitation, in common with other phases of airline operation, has universal application and importance.

### Airline Food Service

In their efforts to attract and hold new business, aircraft operators vie with each other to provide tasty, attractive meals for passengers. This culinary spirit is probably not so keen in the United States as it is in other countries, where planes on epicurean flights at times go out of their way to provide time aloft for the eating of meals. Nevertheless, domestic scheduled airlines today are spending more money to feed their passengers than they spent not many years ago to fly them. The cost for complimentary meal service on scheduled airlines in 1954 was more than \$22 million.

Overseas airlines are often equipped with galleys for the storage and preparation of pre-cooked frozen foods. This type of service on domestic airlines is precluded by weight, space, and flight-time restrictions.

Foods and beverages for domestic aircraft are prepared in catering establishments or carrier-owned commissaries. Airline catering has become a specialized trade. Airline equipment has been devised for the packing, storing, and transporting of meals. As a precaution against contamination of food and drink from the time the meals are prepared to the time they are served aboard the plane, lightweight and compact mechanical refrigeration units have been developed for aircraft.

Meats, cooked vegetables, and other hot comestibles are placed in casseroles, where they are kept hot either in large, preheated vacuum jugs or in portable, electrically heated ovens.

Cold portions of meals, such as salad dressing, bread, butter, dessert, cream, and condiments, along with utensils and napkins, are placed on trays which are packed in carrying cases, with dry ice.

Beverages are stored and transported in stainless steel, constant-temperature containers, which often are chilled by dry ice placed in a recessed tube in the lid of the container.

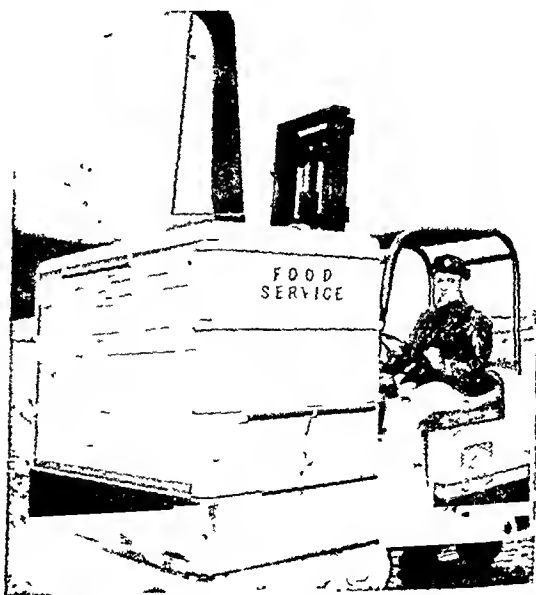
After the meal, unconsumed foods and soiled utensils are returned on the individual serving

trays to the carrying cases. Liquid and paper wastes are put in covered or enclosed metal receptacles. Tray carriers and waste containers are removed by catering personnel for emptying and cleaning, prior to re-use on later flights. Suitable refuse containers, storage areas, and container-cleaning facilities must be provided at the catering point.

It is not feasible to clean and destroy microbes on multi-use eating and drinking utensils aboard aircraft, where water supplies and waste retention facilities are restricted by space and weight allowances. Since washing is necessarily performed at ground installations, enough utensils are needed on the craft to give each passenger a clean set.

### Preventing Food Contamination

There has been a strong cooperative effort directed against the contamination of food. Galley equipment is designed to facilitate cleaning by the aircraft operator in compliance with food sanitation standards. Rounded corners, tight seams, and removable parts aid in preventing accumulation of dirt and harborage of vermin. Unless design and construction are combined with proper cleaning and maintenance,



Foods and beverages are delivered in enclosed carts.

nance, insects and rodents may be attracted aboard aircraft by remnants of food in the cabin and in the galley area (8).

Despite precautions, few operating airlines have escaped at least one outbreak produced by food contamination although outbreaks reported have been relatively minor, both as to number of cases and seriousness (8, 9).

Symptoms often develop within a short time after swallowing contaminated food. Unquestionably, a pilot suffering from severe nausea, vomiting, headache, diarrhea, or cramps would be strained to assure the safety of his plane, passengers, and crew. Thus, although the primary aim of sanitation is to prevent the spread of communicable disease, an immediate benefit of the program is to enhance safety by protecting the health of the pilots.

Serving of box lunches on commercial airlines has increased with the advent of tourist flights. Box lunches often are served during military movements and other chartered flights. Foods usually included in box lunches are particularly vulnerable to contamination. Aircraft have no equipment for keeping box lunches hot or cold to retard bacterial growth. The selection of food for a box lunch and its management require unusual consideration.

Two violent outbreaks which occurred simultaneously on planes of two domestic airlines in 1954 were traced to box lunches prepared by one caterer. Both outbreaks affected military personnel on charter flights.

Also in 1954, several crew members and about half of the passengers became violently ill aboard a United States plane operating in foreign traffic. Fortunately, the plane was returned safely to a stopover point. There the sick were hospitalized. Sandwiches served on this flight had been prepared at a foreign station and were found to be grossly infected with staphylococci.

Alerted by these experiences and aware of the inherent dangers to health in box lunch food service, the Joint Committee on Airline Sanitation sought the recommendations of the Service in preparing a specific sanitary guide for the safe preparation, storage, and handling of box lunches. The result was the Guide to Safe Airline Box Lunch Service, which the committee has recently issued to all airline caterers.

The prolific growth of pathogenic organisms in box lunches is generally attributable to inadequate refrigeration or lack of refrigeration. Recently, several catering chains have purchased portable, insulated, mechanically refrigerated carts in which to store lunches and transport them to the points of sale.

### **Aircraft Water Supply**

The availability of safe, potable drinking water is no less important in the plane at 10,000 feet than it is at ground level in the cities and towns. Concern over the quality of drinking water prompted intensive activity in airline sanitation.

Bacteriologically unsatisfactory drinking water samples in alarming proportions were collected from aircraft in 1951. Extensive water sampling and bacteriological examinations revealed the condition to be widespread. Airlines, caterers, and the Public Health Service agreed that the observations pointed clearly to the need for close attention to sanitation, not only of drinking water supplies but of all aspects of airline operation.

Corrective measures were introduced without delay. Immediate action consisted of establishing continuous procedures for the detection and repair of structural flaws which develop through usage in portable water containers and for careful cleaning, filling, storage, and handling of the containers. Manufacturers were urged to improve the design of equipment to conform with sanitary construction standards.

Drinking water is usually supplied in 2-quart, 6-quart, or 8-quart stainless steel, constant-temperature containers, which are filled at catering establishments. The largest containers have recessed tubes, built integrally with the lids, into which ice can be placed for chilling the water. The apparent simplicity of this procedure belies the serious problems encountered by airlines in providing safe, palatable water.

Except in certain large planes, wash water is supplied from a separate system. This is usually of rudimentary design, consisting of a tank in, or near, the toilet room and a short length of pipe through which water flows by gravity to the draw-off point at the lavatory sink.

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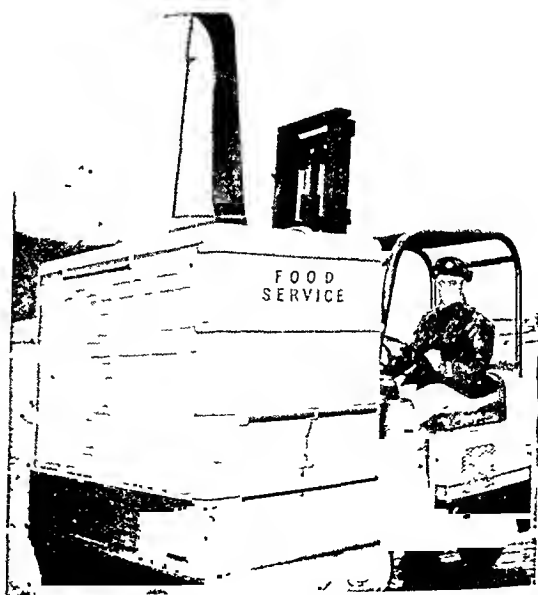
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Foods and beverages are delivered in enclosed carts.

## Design of Water Systems

Aircraft water systems in the past were designed after other equipment layout was completed. As a result, the amount of leftover space available determined the size, shape, and location of tanks, complicated their accessibility, and invited possible contamination. If the space for water tanks is allocated during the early design stages, the water system can be planned in relation to the entire plane and its intended use.

As with other engineering developments, simplicity generates dependability so that a well-designed water system is free of unnecessary, complicated parts which require maintenance and which are subject to breakdown. Simplicity makes the gravity-feed system desirable, but inflexibility of tank location sometimes makes it impracticable. Since there is usually little room in the roof of a passenger cabin to install tanks in keeping with the decor, it is often necessary to install an electric pump or other force type of feed which does not limit the tank size and location.

Sanitary design requires that the water tank have no interior cracks, open seams, or protruberances which might provide harborage for contaminants. Careful choice of materials for tanks can prevent subsequent corrosion as well as possible contamination of the water with metal salts which may be harmful to health or unpleasant to taste or smell. Equal care given to the selection of any required protective coatings will prevent possible toxic effects.

Prevention of freezing is the principal difficulty in assuring trouble-free installation of aircraft water systems. Direct contact between the fuselage skin and the water system is avoided by proper location or insulation of tanks and pipes. A completely drainable system which can be emptied easily may escape damage when the plane is standing idle in freezing weather. It is easy also to flush such a system periodically.

Sanitary design requires a distribution system protected against the introduction of contamination by backflow. A vacuum breaker should be installed in the supply line when the water delivery to fixtures is not through an air-gap.

Water drawn from any tap on the water system of an aircraft should be fit for human consumption, but it takes careful planning and good maintenance to adhere to this standard.

According to the Interstate Quarantine Regulations, water must be safe in quality and handled in a sanitary manner before it is considered acceptable for use aboard carriers. Therefore, the use of strainers or filters in aircraft water systems is not required by the Public Health Service.

When filtering devices are provided aboard aircraft, the Service recommends that they be easily accessible and so constructed that they can be cleaned and sterilized or replaced with sterilized units routinely. Otherwise, filtering devices tend to harbor bacteria. Sometimes use of the filter promotes a false sense of security to the extent that cleaning and sterilization are neglected.

Similarly, treatment of water aboard air conveyances is not required. However, a carrier's decision to practice supplemental treatment may be an added safeguard.

Along the international airways, there is interest in design of the water-servicing panel on the skin of the ship.

If the panel is opposite to the sewage and other servicing panels, there is less possibility of contaminating the water during the filling operation. This possibility is reduced still further when the water panel is clearly labeled and protected from dirt, oil, and other contaminants by a hinged cover. Connections should be quick-coupling and of a size different from other connections. They should be fitted with tight-sealing caps, with keeper chains.

As airports lack hydrants on the ramps, water is usually transported to aircraft in carts. The Service recommends that these be of sanitary design, cleaned routinely, clearly labeled, and used for no purpose which could affect the quality of the water. A direct hose connection from a hydrant to the aircraft water tank would, of course, minimize water handling and chance contamination.

## Aircraft Sewage Disposal

Commercial airlines rightly insist that toilet facilities on the planes be adequate, convenient,

On older craft, the tanks are filled from buckets. The tanks on newer planes are filled by pumping water from a movable cart.

Waste water is discharged directly overboard from older aircraft. On pressurized planes, waste water generally is stored in retention tanks so as to avoid the complicated airlocks or similar devices which would be necessary to prevent pressure loss.

Indications are that the entire general system for supplying drinking water on domestic aircraft will be revised in the future.

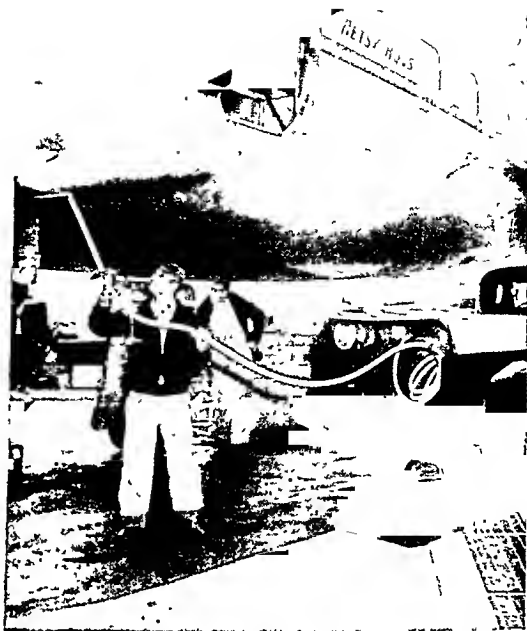
### Single Water Systems

The history of unsatisfactory bacteriological quality of drinking water in many constant-temperature containers, the extra handling involved, and the constant vigilance necessary to prevent chance contamination of the water when portable containers are used led the Public Health Service to advocate the installation on aircraft of single water systems which supply potable water for drinking, washing, and all other purposes. Single water systems are to be found on some air conveyances operating in international traffic, on some foreign aircraft, and on some planes of one domestic operator.

The many technologic problems to be considered in designing a satisfactory and sanitary water system for aircraft are complicated by space, weight, and safety considerations. In view of weight limitations, the amount of water permitted is small. However, water may be even more necessary aboard planes than it is on surface carriers because of the problem of maintaining ground temperature and humidity conditions in passenger cabins at operating heights (8, 10).

Cumberland and Bowey (10) report the experience of British Overseas Airways Corporation, which might be considered in estimating water supply requirements on United States flights. On BOAC planes, 3.75 pounds of water per passenger has been found to be adequate for drinking and washing purposes on flights of 1 to 3 hours' duration; 6.88 pounds for day flights; and 9.38 pounds for night flights of 3 to 5 hours. Ten pounds per passenger is provided on flights from 5 to 12 hours long.

Comparable information on United States



Filling an aircraft water system at stopover point.

flights is not available. However, McFarland (8) estimates that the average water intake for a passenger on an air transport is about 1.4 pounds during each 6 hours of flight. Since one-half of this amount would be available in the food served aboard the plane, it would be necessary, if food is served, to provide only 0.7 pound of drinking water per person for a 6-hour flight.

Estimates of the amount of water required for washing are more variable. On large aircraft, the supply ranges from 5.0 to 6.7 pounds a person. United States transoceanic airlines supply at least 10 pounds of drinking and washing water for each person on overseas flights of approximately 12 hours.

These seemingly small water requirements account for a significant weight increment in larger craft. The problem has stimulated research on the possibility of recovering water by various means during flight. Water recovery from engine exhaust gases, reclamation of used ablution water, and recovery of water vapor condensate within the aircraft have been investigated as possibilities. Up to now, each of these leads has proved unsatisfactory because of engineering, hygienic, esthetic, or safety implications.



terminal servicing, it was necessary to introduce valves, piping, and other fittings into the containers.

### **Odor Control, Incineration**

Although odor-destroying substances are used in aircraft sewage retention tanks, the Public Health Service does not accept their use in lieu of effective cleaning. The product used must suppress sewage odors for prolonged periods over a wide range of temperatures, but it should not be a nuisance or a danger to the passengers or craft. It is important that it not mask odors of leaking gasoline, hydraulic fluid, oil, smoke, or other danger signals normally detected by the sense of smell.

It is required that the toilet room and galley be as distant from each other as possible. Vitiating air from toilet rooms is discharged overboard rather than recirculated in the plane's air-conditioning system. This system of ventilating is effective during flight, but not always at stopover points and terminals.

The airtight, watertight receptacle used by airsick passengers for containers should likewise be widely separated from the galley.

Current research and development appear to be concentrating on incineration of sewage and dejecta while the plane is in flight. An electric incinerator has been developed, but its power requirements may be excessive for present aircraft. Incineration by fuel or electricity is complicated by safety considerations.

### **Other Health Services**

As with vessels and railroad passenger cars, the Public Health Service awards Certificates of Sanitary Construction for aircraft constructed in compliance with requirements of the Interstate Quarantine Regulations. Review of plans and specifications concerning features with health significance assures that defects which might require subsequent costly changes are not built into a plane. It is becoming general practice for carriers to specify that the manufacturer must obtain the certificate before delivery of a conveyance will be accepted.

To assure compliance with the Interstate Quarantine Regulations relating to the sanitation

of food, water, milk, and frozen dessert supplies, a continual program of inspection is conducted in cooperation with State health departments. Subsequent to each inspection, a source is classified as approved, provisionally approved, or prohibited for use by interstate carriers.

Airlines are kept informed of the sanitary status of suppliers by the semiannual publications, the Official Classification of Airline Catering and Watering Points and the Official Classification of Milk and Frozen Dessert Sources.

Approximately 200 servicing areas are regularly inspected. Plans for construction or major reconstruction of terminal facilities are reviewed when public health is concerned, and inspection and consultation are continued during construction.

Public Health Service and State and local health department technicians are prepared to investigate disease outbreaks occurring on aircraft.

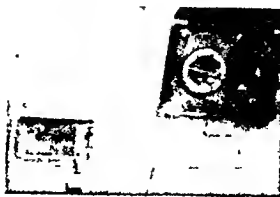
Service personnel of the regional offices are prepared to instruct airline employees in airline sanitation, to assist in developing visual aids and other educational material, and to interpret regulations for carriers as an aid in the formulation of company rules governing airline employees.

Service studies and investigations relating to airline sanitation are conducted to assure that equipment is designed and fabricated in accordance with standards and requirements of the Interstate Quarantine Regulations.

Problems faced by United States airlines which operate overseas are particularly perplexing. Most of these lines attempt to follow the standards established for interstate travel in the Handbook on Sanitation of Airlines. They conscientiously try, by the most appropriate means, to load only acceptable food, milk, and water supplies, and to provide adequate facilities and operating procedures for the safe and sanitary disposal of sewage and refuse. Their efforts, nonetheless, are greatly complicated by local customs, illness among native workers, and public health practices which are not consistent at all stations.

Aircraft sanitation services are fitting items for international standardization. The Public

## Sewage Disposal on a Modern Airliner



Left: Compact toilet room. Above: External servicing panels with waste water valve and drain (left) and sewage outlet, flushing water inlet, and valve. Right: Large hose drains sewage into cart beneath plane. Small hose pumps flushing water and deodorant into toilet.



and inoffensive. Consequently, the design and installation of sewage facilities are now facets of the aeronautical sciences (11).

Both Interstate Quarantine Regulations and the International Sanitary Regulations (12) prohibit the discharge of excrement from aircraft in flight. None of the methods investigated for rendering sewage innocuous prior to disposal overboard have proved satisfactory from medical or engineering viewpoints (8, 11, 14). Sewage is stored aboard the plane pending disposal at servicing areas.

Present weight and space limitations preclude the provision for flushing water and storage tanks. A system employing waste wash water for toilet flushing, built into a few airplanes, was later removed because of operating difficulties.

On older aircraft a chemical toilet retains sewage wastes, and a small amount of deodorant-disinfectant solution is placed in a carry-out pail, housed in a vent chamber.

At the airport, a maintenance man carries the bucket through the passenger cabin to a cart or truck to be emptied into a sewer. The bucket is cleaned inside a closed cabinet connected to a sewer, recharged with chemical solution, and returned to the plane.

On newer planes, however, the toilet-servicing panel is recessed in the skin of the fuselage. The panel contains a waste discharge outlet, a

flushing-water inlet, and valves. Couplings—a different size from the water couplings—permit easy attachment and release of hoses. Servicing pipes are sealed with removable blanking caps. Connections are tight to prevent leakage.

A crew empties the sewage by gravity flow through a large flexible hose into a cart or truck, flushes the aircraft sewage container with water from the cart or an auxiliary cart, and pumps fluid chemical into the toilet tank for recharging.

The carts with waste-receiving, flushing-water, and deodorant tanks for ground servicing are maintained separately from drinking water and food service equipment, by a separate crew.

### Sewage Retention Capacity

The sewage retention capacity of toilet tanks depends on the number of passengers carried and the duration of the flight. For design purposes, the rate of body waste production per hour per person is estimated at from 0.014 to 0.019 gallon. Dejecta from airsick passengers is not overlooked in estimating waste retention capacity of toilets.

The volume of tanks is increased commensurately with seating capacity and length of flight.

Rounded corners and smooth seams and joints facilitate cleaning of toilet tanks. With ex-

# Third Antibiotics Symposium

These are abstracts of a few papers from the third annual Symposium on Antibiotics, held November 2-4, 1955, in Washington, D. C., under the sponsorship of the Food and Drug Administration and in collaboration with the journals, *Antibiotics and Chemotherapy* and *Antibiotic Medicine*. Eleven concern penicillin V. Three deal respectively with antibiotic therapy of sleeping sickness, venereal diseases, and virus diseases.

The proceedings of the symposium have been published in the *Antibiotics Annual, 1955-1956*, issued by Medical Encyclopedia, Inc., 30 East 60th Street, New York 22, N. Y.

## Antibiotics in the Treatment of Virus Diseases

The role of antibiotics in the treatment of bacterial diseases has been fairly well delineated. With respect to virus diseases, however, the role of antibiotics still greatly needs clarification.

Four factors contribute to the problem:

1. Accurate diagnosis is difficult, and antibiotics are used on the chance that a particular illness may be of bacterial rather than of viral origin.

2. Confusion arises from the classification of Chlamydozoaceae with the true viruses.

3. A widespread belief prevails that antibiotics will at least be useful in preventing secondary bacterial infection.

4. There is an unjustified assumption that "at least antibiotics can do no harm."

Evidence suggests that the use of antibiotics may actually delay recovery in the following diseases: influenza, the common cold, herpangina, poliomyelitis, measles, and mumps.

Smallpox, chickenpox, and herpes zoster are virus diseases in which antibiotics may be helpful because of their effects upon secondary bacterial infection.

The need for further controlled studies is stressed.

—BARBARA MOULTON, *Division of Medicine, Food and Drug Administration, Washington, D. C.*

## Erythromycin Therapy of Venereal Diseases

Although penicillin is the antibiotic of choice in therapy of most venereal diseases, the increasing incidence of hypersensitivity to this agent necessitates that other antibiotics be evaluated for their efficacy in treating venereal diseases in patients known to be sensitive to penicillin. Erythromycin was selected because its in vitro activity most closely parallels that of penicillin.

Health Service standards are a contribution toward attainment of this objective.

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NOTE: The photographs have been supplied through the courtesy of American Airlines, Pan-American World Airways System, Sky Chefs, and Allied Aviation Services.

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## PHS Staff Announcement

**Abraham W. Fuchs**, chief of the milk and food program of the Public Health Service from 1940 to 1952, retired on March 1, 1956, after 39 years with the Service, 26 of them as an engineer officer of the commissioned corps.

For the past year, Mr. Fuchs has been chief of the Field Party, United States Operations Mission, Kingston, Jamaica. He has returned to Jamaica as an adviser on environmental sanitation for the International Cooperation Administration.

In a distinguished career with the Public Health Service, Mr. Fuchs helped State and local agencies to develop milk and food sanitation ordinances and codes and to initiate cooperative programs with industry for the improvement of the sanitary quality of milk supplies. During World War II, his atten-

tion was directed toward adequate milk supplies for critical defense areas and demonstration classes for food handlers. His research focused on sanitary design and adequacy of pasteurization equipment. He developed basic design criteria for leak-protected valves on vat pasteurizers.

From 1952 to 1955, Mr. Fuchs was chief of the Health Division, United States Operations Mission to Israel. The Association of Milk & Food Technology awarded him its citation award last October. He had served as an associate editor of its journal since 1947, as president of the association in 1949, and as a member of the executive board for 6 years.

Mr. Fuchs obtained his civil engineering degree with a major in sanitary engineering at Cornell University in 1913.

all times tested. This was accompanied by an increase in the percent of positive blood samples taken at 6 and 8 hours after a single dose. A twofold increase in the amount of penicillin V acid in capsule form gave proportionately higher blood concentrations 1 hour after administration and slightly higher after 2 hours and 4 hours. Thereafter, the penicillin blood concentration did not increase above that of the lower dose. The number of subjects showing a penicillemia at this higher dosage was the same as that for the lower dosage with the possible exception of the fourth hour, where the difference between the lower dose and the higher dose rose from 82 to 100 percent positive.

Benzathine penicillin V, both tablets and oral suspension, produced significantly higher blood concentrations than comparable doses of penicillin G for the first 4 hours. Thereafter, benzathine penicillin G gave significant penicillin concentrations for 6 to 8 hours in 50 percent of the subjects, while benzathine penicillin V blood concentrations gave only 10 percent positive after 6 hours and were substantially negative after 8 hours.

—LAWRENCE E. PUTNAM, WILLIAM W. WRIGHT, and HENRY WELCH, *Division of Antibiotics, Food and Drug Administration.*

### **Blood Levels in Patients Receiving Oral and Intramuscular Penicillins: 24-Hour Study**

This study, at the Robert W. Long Hospital, Indiana University Medical Center, was designed to compare blood levels of penicillin V with penicillin G and aqueous procaine penicillin G.

Six patients were given penicillin G in capsules, 400,000 units orally at 0, 6, 12, and 18 hours. Penicillin blood levels were determined at intervals.

After 2 days, the procedure was repeated using the same unit dosage schedule with penicillin V capsules.

Forty-eight hours later, the six patients were given one intramuscular injection of aqueous procaine penicillin G, 400,000 units, and again penicillin blood levels were determined at intervals.

The blood levels of penicillin V compared favorably with the other two penicillin preparations.

—WILLIAM E. SYMON, *Indiana University Medical Center, Indianapolis.*

### **Comparative Clinical Laboratory Studies: Penicillin V and Penicillin G**

Thirty healthy, ambulatory subjects were given equal amounts of penicillin V or penicillin G orally. The material was ingested in the fasting state and following a standard meal. Blood penicillin concentrations were determined at intervals for 8 hours, using a twofold tube dilution technique. When concentrations of penicillin V and penicillin G were compared directly, whether the subject was fasting or not, early levels with penicillin V were achieved which were maintained higher and longer than with penicillin G. Analysis of the data expressed as total penicillemia per 8-hour period revealed that with or without food, penicillin V produced greater blood penicillin concentrations than did penicillin G. There was only a 16-percent difference in penicillin V concentration when it was given fasting or with food. Penicillin V in the fasting state also produced a 61 percent greater concentration than did fasting penicillin G. Penicillin V given with food showed a penicillemia 224 percent greater than penicillin G taken with food. Furthermore, even when penicillin V given with food was compared to penicillin G in the fasting state, 38 percent greater penicillemia values were obtained with penicillin V than with penicillin G.

—FRANKLIN B. PECK, Jr., and R. S. GRIFFITH, *Lilly Laboratory for Clinical Research, Indianapolis Hospital, Indianapolis.*

### **Effectiveness in Acute Gonorrheal Urethritis**

Advantages inhere in both oral and parenteral medication. The choice depends upon the circumstances at hand. The advantages that an oral preparation of penicillin offers over the intramuscular injection are primarily those of convenience and a decreased possibility of sensitization or allergic response. There is therefore

Initially, consecutive patients received erythromycin by mouth. The majority had gonorrheal urethritis. Of 132 patients receiving a total dosage of 0.8 to 1.2 gm., good clinical results were obtained in 114, indifferent in 10, and poor in 8. Fewer cases of nonspecific urethritis and chancroid were available. The results with much larger doses were not striking. The bacteriological results in the cases of gonorrhea were in close agreement with the clinical results.

Another group, all of whom had gonorrhea, received 100 to 200 mg. of erythromycin intramuscularly. Of the 88 patients studied, good clinical results were obtained in 77, indifferent in 5, and poor in 6. More detailed analysis of these data reveals the best results to be in those receiving larger doses.

It appears that erythromycin is a satisfactory substitute for penicillin, especially when given intramuscularly in adequate dosage.

—THOMAS H. HAIGHT, *department of medicine, University of Oklahoma School of Medicine and University Hospitals, and the Prevention and Control Center, Oklahoma City.*

### **Stylomycin in Human Sleeping Sickness: 17-Month Followup**

Fifteen cases of sleeping sickness (*Trypanosoma gambiense*) were treated with stylomycin (puromycin) for 7 to 10 days. The daily dosage used was 1 to 2.25 gm., the total per patient ranging from 9.5 to 13.5 gm. Clinical diagnosis was confirmed by blood cultures (Weinman's medium modified by Henraard and Peel as recommended by Neujean and Evans), cerebrospinal examinations, and microscopic examination of material from the lymph glands. Periodic controls were carried out in the same manner.

Before treatment, material aspirated from the lymph nodes of all patients showed trypanosomes, all spinal fluids were abnormal, and 11 patients yielded positive blood cultures. At the last control, 17 months after treatment ended, 10 patients were negative, 4 relapsed during the first 6 months, and 1 presented

abnormal spinal fluid without any other laboratory sign of the disease.

—CARLOS TRINCAO, ALMEIDA FRANCO, ALFREDO NOGUEIRA, A. R. PINTO, and HEINZ MUEHLFORDT, *Kumamoto University Medical School, Honjo-machi, Kumamoto shi, Japan.*

### **PENICILLIN V**

#### **Blood Concentrations Following Oral Administration and Comparison With Penicillin G**

Penicillin V acid in tablet and capsule forms and benzathine penicillin V as tablet and oral suspension have been administered orally to a large number of human subjects. The penicillin blood serum concentrations were determined 1, 2, 4, 6, and 8 hours after a single dose. Crystalline penicillin G potassium or benzathine penicillin G in similar dosage forms were also tested. Tablets or capsules containing 200,000 units of penicillin V acid produced significantly higher blood concentrations than comparable penicillin G preparations. The highest initial blood concentration was given by penicillin V acid capsules 1 hour after administration. Thereafter, the capsules and the tablet formulation gave the same penicillin blood concentrations.

The average concentration of penicillin in the serum 1 hour after the administration of penicillin V acid tablets was 0.884 unit per milliliter, while potassium penicillin G tablets gave only 0.578 unit. Penicillin V acid in capsules given to 50 subjects yielded an average blood concentration of 1.098 units per milliliter 1 hour after administration, while potassium penicillin G in capsules gave only 0.699 unit. The duration of the penicillemia was the same for both penicillin V and penicillin G in either dosage form. Detectable penicillin blood concentrations were found in more than 80 percent of the subjects for 4 hours, and in about 40 percent for 6 hours with either penicillin V or G.

An increase of two and one-half times in the dose of penicillin V acid in tablet form gave proportionately higher blood concentrations at

pendence on metabolism (Clowes and others). Inactivation of penicillin G (benzylpenicillin) and penicillin V (phenoxymethyl penicillin) was examined on liver slides of guinea pigs, using the Warburg apparatus. Inactivation was found to be anaerobic and aerobic, increasing with the amount of penicillin concentration. Investigations with activators, inhibitors, and metabolites show that there is an adaptive ferment which is built up under the influence of penicillin and with use of metabolic energy.

—K. H. SPRITZ, *University Clinic, Vienna, Austria.*

### Serum Penicillin Concentrations Following Oral Administration

Capsules containing 200,000 units of penicillin V and commercial 200,000 and 500,000 unit tablets of penicillin G were administered with respect to meals to adults with no evidence of cardiac, renal, or hepatic disease. Serum penicillin concentrations were determined by the *Sarcina lutea* disc-plate method and serial two-fold tube dilution technique. Zone diameters with the plate method were somewhat smaller with penicillin V than with penicillin G and were usually not obtained at concentrations of 0.03 unit per milliliter.

Mean serum concentrations at  $\frac{1}{2}$ , 2, 4, and 8 hours, following doses of 400,000 units of penicillin G were 1.0, 0.88, 0.38, and 0.16 unit per milliliter, respectively, and following penicillin V, same doses, were 0.57, 1.46, 0.49, and 0.08 unit per milliliter, respectively. Eight hours after administration, 12 of 15 patients receiving penicillin G had levels of 0.03 unit per milliliter, or greater, contrasted with 6 of 12 patients receiving penicillin V.

Mean serum penicillin concentrations at the same intervals following 1 million unit doses of penicillin G were 1.31, 1.19, 0.32, and 0.14 units per milliliter, and those following penicillin V, same doses, were 1.83, 2.44, 1.3, and 0.27 units per milliliter. Twelve of fourteen patients receiving penicillin G had levels of 0.03, or greater, 8 hours after administration as compared with 5 of 7 patients receiving penicillin V.

Penicillin concentrations of the serum samples were relatively stable in the case of both

penicillin G and penicillin V at  $-20^{\circ}\text{C}$ ., but in the serum penicillin V showed considerably more rapid deterioration than penicillin G at  $10^{\circ}\text{C}$ .

Additional pharmacologic data is being accumulated.

—HERBERT LINDEN, SYDNEY FINEGOLD, and WILLIAM L. HEWITT, *departments of medicine of the University of California Medical School and of the Veterans Administration Center, Los Angeles.*

### Some Observations as to Solubility and Stability

Comparisons are made between penicillin V acid, potassium penicillin G, potassium penicillin V, benzathine penicillin G, and benzathine penicillin V with respect to solubility and stability of suspensions and solutions at various pH levels over definite periods of time.

In vivo tests made include comparisons of penicillin V and potassium penicillin G in mouse protection tests against virulent type 1 pneumococci, serum concentrations in chickens following oral administration of the same two penicillins, and human serum concentrations resulting from parenteral injection of the benzathine salt of phenoxymethyl penicillin (penicillin V).

—WILLIAM ELIAS and H. JOSEPH MERRION, *Wyeth Laboratories, West Chester, Pa.*

### Some Properties Such as Stability

Phenoxymethyl penicillin (penicillin V) is more stable than benzylpenicillin at  $\text{pH} < 6.5$ . At higher pH the condition is the reverse. There is a relatively rapid inactivation of penicillin V in serum. The in vitro activity of penicillin V against strains of *Staphylococcus aureus*, beta hemolytic streptococcus, and pneumococcus in our experiments is the same as that of benzylpenicillin. Against a strain of a non-pathogenic *Staphylococcus albus*, penicillin V was 80 percent more active than benzylpenicillin. The reason for this is not known.

Because of its physicochemical properties, penicillin V is suitable for oral administration.

a need for an oral preparation of penicillin, one that will not be destroyed by the gastrointestinal pH and that will be readily absorbed, giving adequate body fluid and tissue concentrations.

Penicillin V (phenoxymethyl penicillin) is such a preparation and it has been reported to be effective in the treatment of certain diseases caused by penicillin-susceptible organisms.

The results obtained to date in our experience with a small number of patients, summarized below, indicate that 1.8 million units is the minimal dose for use in this infection and that a somewhat higher dose may be more effective.

Total dosage (units)	How administered	Num- ber of patients	Cures	Fail- ures
800,000	400,000 twice daily	5	0	5
1,200,000	800,000 initially 400,000 at 6 hours	4	1	3
1,200,000	400,000 thrice daily	3	1	2
1,800,000	600,000 thrice daily	10	8	2

It appears, therefore, that penicillin V administered orally may be used in treatment of gonorrhea. The study, the methods and procedures of which have been described elsewhere, is being continued.

—MILTON MARMELL and AARON PRIGOT, *Departments of Pathology and Surgery and Department of Hospitals, New York City.*

## Pharmacologic and Toxicological Studies

Penicillin V (phenoxymethyl penicillin) has been shown to be more acid resistant and to produce higher blood levels after oral administration in human test subjects than penicillin G. Studies in laboratory animals have proved the safety of penicillin V and have confirmed the increased absorption and blood levels.

The acute toxicities of penicillin V, sodium penicillin V, and sodium penicillin G have been compared following administration to mice by several routes. The LD<sub>50</sub>'s ± standard error in milligram per kilogram were: for penicillin V, intraperitoneally 1,351 ± 68, subcutaneously and orally greater than 4,000; for sodium penicillin V, intraperitoneally 2,281 ± 74, subcutaneously 2,440 ± 66 and per os greater than 4,000; and for sodium penicillin G, intraperitoneally 3,314 ± 146, subcutaneously and orally greater than 4,000.

Rats fed diets containing up to 2 percent penicillin V for 2 months gained weight and showed no visceral or hematopoietic damage. Dogs that received daily doses of 200 milligrams per kilogram for the same period also remained normal.

In dogs, the renal clearance was slightly lower for penicillin V than for penicillin G. The secretion of penicillin V by the renal tubules was inhibited by probenecid. Penicillin V was bound by plasma protein to about the same extent as penicillin G.

Blood levels have been determined in several species of experimental animals following oral administration. Penicillin V produced higher levels than penicillin G in most instances.

—ROBERT C. ANDERSON, C. C. LEE, H. M. WORTH, and K. K. CHEN, *Lilly Research Laboratories, Indianapolis.*

## In the Treatment of Subacute Bacterial Endocarditis

Three cases of subacute bacterial endocarditis (two due to alpha hemolytic streptococci and one due to *Neisseria sicca*) were treated with oral penicillin V. The dose was two million units every 4 hours.

Penicillin V blood levels (*Sarcina lutea* cup-plate method) ranged between 5.6 and 20 units per milliliter of serum.

One patient was treated for 42 days with a total of 508 million units of penicillin V with clinical and bacteriological remission.

Two of the three cases exhibited clinical relapse after 1 week of treatment. In both cases multiple blood cultures remained sterile. The addition of streptomycin (2 grams per day) to the therapeutic regimen resulted in remission.

No untoward reaction to penicillin V at this dose level was encountered.

—E. L. QUINN, J. M. COLVILLE, F. COX, and J. TRUANT, *Infectious Disease Clinic, Henry Ford Hospital, Detroit.*

## Inactivation in Tissues and Body

All of the administered penicillin does not appear in urine. Loss is mainly due to inactivation in tissues, especially the liver, with de-



pendence on metabolism (Clowes and others). Inactivation of penicillin G (benzylpenicillin) and penicillin V (phenoxymethyl penicillin) was examined on liver slides of guinea pigs, using the Warburg apparatus. Inactivation was found to be anaerobic and aerobic, increasing with the amount of penicillin concentration. Investigations with activators, inhibitors, and metabolites show that there is an adaptive ferment which is built up under the influence of penicillin and with use of metabolic energy.

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Because of its physicochemical properties, penicillin V is suitable for oral administration.

After single oral doses of penicillin V, the concentration in serum during the first 3 hours after the administration is 2 to 3 times greater than that achieved with the same amount of benzylpenicillin. The concentration in serum then falls more rapidly than when benzylpenicillin is administered. After a single oral dose of 0.30 gm. of both penicillins the serum concentration is the same 6 hours after the administration. Lower stability at pH > 6.5 and greater inactivation, by serum, of penicillin V than of benzylpenicillin may be the explanation of this. When penicillin V is given together with probenecid the concentration in serum is twice that obtained with the same dose of penicillin V alone. Furthermore, the period of time during which an effective penicillin concentration is present in the blood is prolonged. An oral dose of 0.12 gm. of penicillin V and 0.7 gm. of probenecid once every 8 hours maintains continuously a concentration in serum that is effective for the majority of infections caused by bacteria sensitive to penicillin.

—N. A. DIDING and A. RÖNE FRISK, *Stockholm, Sweden*.

### Toxicological Properties of Various Forms

Acute and chronic toxicity of penicillin V was investigated in mice, rats, guinea pigs, rabbits, and dogs; and the effects following various

routes of administration were compared with those of procaine penicillin G, potassium penicillin G, and N, N'-dibenzylethylenediamine (DBED) dipenicillin G. After oral, intramuscular or intra-abdominal administration, the toxicity of penicillin V and DBED dipenicillin V compared favorably with that of the other penicillin forms similarly administered. Intravenously, penicillin V, it was found, could be administered rapidly without untoward effect and when compared to potassium penicillin G administered at the same rate, the latter was approximately 8 to 10 times more toxic. The mean gain in weight of rats fed 0.1 or 0.2 percent penicillin V or DBED dipenicillin V in the diet for 8 weeks was similar to that of the controls fed only the basal diet. Neither dogs administered intramuscularly or orally 100 mg./kg. daily, nor rabbits intramuscularly administered 20 mg./kg. for 8 weeks exhibited any unusual behavior or serious alterations in their mean body weights. Periodic hematological studies and microscopic examination of tissues following complete autopsies at the termination of the experiments revealed no significant changes as a result of the penicillin V or the DBED dipenicillin V.

—JEROME M. GLASSMAN, WILLIAM J. BECKFIELD, EDWARD M. GORE, ALPHONSE DERVINIS, RICHARD TISLOW, and JOSEPH SEIFTER, *Wyeth Institute for Medical Research, Radnor, Pa.*

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## Medical Review Bibliography

A Bibliography of Medical Reviews is scheduled for publication in May 1956 by the Armed Forces Medical Library. Arranged by subject, it will contain approximately 800 references to review articles in clinical and experimental medicine and allied fields. All of these have appeared during the calendar year 1955.

Copies of this bibliography will be supplied in the order requests are received by: The Director, Armed Forces Medical Library, Washington 25, D. C.



## ESTELLA FORD WARNER

*"No Need for Acclaim . . .  
But to Perpetuate  
Influence She Generated"*

Dr. Estella Ford Warner, who retired this year after a distinguished career with the Public Health Service, takes to her adobe home in Albuquerque the warm affection, deep respect, and unqualified admiration of all who have known her. Her retirement is not the occasion to pay her tribute, because she does not need acclaim. Although she has been honored many times, honors are superfluous to her. These comments are offered primarily in the hope that they may help to some degree to conserve and perpetuate the influence she has generated.

When Dr. Warner was recruited for the Public Health Service by Dr. Warren Draper in 1932, she was known both here and abroad for her development of State and county maternal and child health services in Oregon. Although she had a flourishing practice in pediatrics in Portland, where she had earned a medical degree at the State university, she took up public health work because of her conviction that "the best road to good child health is preventive medicine on a community basis."

The first woman to enter the commissioned officer services of the United States, Dr. Warner was an important addition to the Public Health Service both as a physician and as an administrator. At all times, she has personified competence of a very high level.

Her direct contributions to public health have been described elsewhere, if all too briefly.

They are an important element in the chronicles of world health progress, and it is to be hoped that some day they will be celebrated in history as they deserve. The strategic value of her work with mothers and children, with indigenous primitive tribes on reservations in the southwest, with families of warworkers housed in trailers and other temporary quarters during the war, with Federal assistance to State health departments, and with expanding health services in Asia is yet to be seen in perspective.

The achievement in itself is impressive. The effects of programs she advanced for malaria control and sanitation in India alone are certain to extend and enrich millions upon millions of lives.

While what she has done commands respect, these achievements are noteworthy as well for the spirit and method of their accomplishment. Perhaps this is best indicated by the fact that of all those men and women who have been assigned to her staff, there are none who speak of having worked "for" Dr. Warner. It is not an affectation when they say they worked "with" her. It is a tacit and grateful acknowledgment of the fact that in every endeavor she created a pervading sense of shared purpose and action.

She took to heart the doctrine that democracy is a way of working as well as a way of living. As a division chief, she demonstrated her characteristic ability to accept and make use of new ideas and methods. Since it was not in her

nature to be authoritarian, she was always as ready to hear from her staff members as to give counsel and guidance.

Her accomplishments have been world enriching, her methods inspiring. She has attained the high goals she set for herself and, in so doing, has established new goals for those who follow.

With such concepts and attitudes, it was to be expected that her office would be the source of creative ideas in public health, that it would be eager to perform real functions rather than to pretend to formal responsibilities, that it would constantly evaluate, and reevaluate, the performance of public health services.

On the eve of her retirement, she was continuing to encourage health workers in foreign missions to write what they observed and what they were doing about public health, in line with her constant wish to focus health concepts on living processes.

If further tribute is to be paid to Dr. Warner by her colleagues, they can do no better than apply her concepts, to be sensitive to public needs, to observe and report what is being done and what can be done, and to proceed in concert to meet public needs as they are understood.

—By LEONARD A. SCHEELE, *Surgeon General, Public Health Service.*

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## On Rehabilitation

"In Salt Lake City recently, over a 6-month period, half the applicants for public assistance whose need was due to a father's desertion were handled by a trained social worker who stressed the services that would help cure the problem. The other half were handled routinely—their need was established and payments were made, but no special help was given in eliminating the cause of need. At the end of 6 months, assistance payments to the families who had received professional self-help services were 41 percent less than assistance payments to the other families.

"In New York City, over a period of 3 years, a skilled welfare staff focused on a direct effort to return persons to self-support. Of a total of 2,700 cases, involving persons who had been unemployed from 1 to 19 years, 616 were restored to independence as a result of services provided by social workers. The savings in the actual cost of assistance has been \$616,000 per year. But far more important than the savings of tax dollars is the promise of a richer life for human beings.

"In New York State, 3,600 disabled persons were returned to employment and a self-sustaining life through vocational rehabilitation last year. These people were earning less than \$1.5 million a year when they started on the road to self-support. The first year after rehabilitation, their earnings were estimated at more than \$8 million—almost a six-fold increase.

"In the Nation as a whole, more than 11,000 of those rehabilitated last year had been receiving public assistance payments. It cost about \$8 million to rehabilitate this group—but in just one year it would have cost almost \$10 million to maintain them on relief. Relief costs generally were stopped and earnings and tax payments were started, but the richest reward from this program is the conversion of misery and despair into hope, dignity, and a productive life."

—MARION B. FOLSOM, *Secretary of Health, Education, and Welfare.* From an address before the Rochester City Club, Rochester, N. Y., March 3, 1956.

*In planning community X-ray programs, it is useful to know why some people appear for screening and others stay away. A psychological study suggests three apparently significant factors in the public attitude toward chest X-rays.*

## Why People Seek Diagnostic X-Rays

By GODFREY M. HOCHBAUM, Ph.D.

MANY well-organized, efficiently handled, and very successful community X-ray programs have been conducted throughout the United States. Yet, even in the most effective ones, various segments of the population have failed to obtain X-rays. There is evidence that these segments include groups in which tuberculosis is highly prevalent.

It is hoped that better knowledge of factors which determine whether or not people obtain chest X-rays will help in planning more effective programs, especially for those unresponsive population groups. With this in mind, the National Tuberculosis Association and the Public Health Service jointly sponsored a study to identify some of these factors.

For this study, intensive personal interviews were held with 450 persons in Boston, 450 in

Cleveland, and 300 in Detroit, all 25 years of age or older. The respondents were selected in each city on the basis of random population sampling. The interviews, each lasting more than 1 hour, were designed to stimulate the respondents to express their opinions as well as their feelings and attitudes concerning psychological, sociologic, and administrative aspects of case finding for tuberculosis. To learn more about opinions, attitudes, and feelings than is usually expressed when only direct survey questions are asked, use was made of various psychological techniques, such as projective questions.

Of the 1,200 persons interviewed in the 3 cities, only 42 percent had voluntarily and without having any signs or symptoms of illness obtained one or more chest X-rays to check for tuberculosis. Another 16 percent stated that they had obtained X-rays voluntarily, but that they had done so because they had noticed symptoms which they thought might be due to tuberculosis. Fourteen percent said they had had all their X-rays either because other persons or groups had pressed them or because the X-rays had been required for one reason or another. A few persons had had X-rays to check for heart trouble or lung cancer rather than for tuberculosis. For about 10 percent who had had X-rays, no consistent and typical pattern could be established. Seventeen percent of the 1,200 persons had never in their lives had an X-ray.

Whether or not a person voluntarily obtains

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*Dr. Hochbaum is a research psychologist, Behavioral Studies Section, Division of General Health Services, Public Health Service. This article is a modification of a paper he presented at the annual meeting of the National Tuberculosis Association, Milwaukee, Wis., May 25, 1955. It deals with only one set of findings from a study on voluntary participation of the public in tuberculosis case-finding programs. A discussion of all the findings, as well as a fuller description of sampling procedure, study design, and techniques of obtaining data, will be published in monograph form at a later date.*

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a chest X-ray when given the opportunity is the result of a decision made by him. The fundamental problem with which this research was concerned, therefore, can be expressed by the following questions: Why and under what conditions do people decide to seek chest X-rays when given the opportunity? Why and under what conditions do they decide not to? Since a decision to act still may not result in an act, a further question must be posed: What conditions make it more likely or less likely for people who have decided to obtain X-rays actually to obtain them?

Obviously, many factors must be examined to answer these questions. Some of these are psychological in nature; others, sociologic; and still others, situational. No single factor ever determines by itself whether a person will or will not voluntarily obtain a chest X-ray. Hence, the study was designed to deal with a variety of factors. It was designed, further, not only to identify the factors that influence people to seek diagnostic X-rays, but also to determine how various factors affect each other.

This report is concerned with only one set of factors investigated by the study. These factors, even when considered by themselves, appear to be of particular significance to the question of why people seek diagnostic X-rays. A report to be published at a later date will discuss these factors in relation to several others investigated in the study.

### The Three Factors

The first in this set of factors is a person's conviction that he himself could really contract tuberculosis.

The second is a person's conviction that he might have tuberculosis for a considerable period of time without being aware of it—that is, without experiencing any outward symptoms of illness—and that only through a chest X-ray could the fact that he has the disease be ascertained.

Among 798 persons in the sample who had unrestricted freedom and opportunity to obtain X-rays (that is, excluding persons who had had X-rays because they were required to do so and also those who obtained X-rays for reasons not relevant to this analysis), 442 believed that

they could contract tuberculosis and also that X-rays alone would show the presence of the disease at an early stage. Over 80 percent of this group, although feeling healthy and free from any symptoms at the time, had voluntarily obtained X-rays. In contrast, 356 persons either did not believe that they would ever contract tuberculosis or were certain that they would be aware of it if they had the disease. Half of this group either had never had X-rays or had obtained them only after they had noticed what to them seemed suspicious symptoms.

From the nonmedical point of view, this behavior is quite rational. If a person is convinced—rightly or wrongly—that he will never have tuberculosis, it would seem to him a complete waste of time and effort to check on whether he does have it. And if a person is convinced that there will be some sign of illness, some pain or disfunction, as soon as he has become infected, he is also convinced that he could not have tuberculosis as long as he feels completely well. Such a person, too, would regard X-rays as completely unnecessary and would obtain them only when he notices signs which he thinks might be symptoms of tuberculosis.

Briefly, then, the findings indicate that people are likely voluntarily to seek diagnostic X-rays only if they really believe that they might contract tuberculosis and that it would be dangerous to rely on the appearance of outward symptoms.

The third factor is a person's belief that early detection of tuberculosis would decrease the problems and worries which he thinks would arise for him should he ever contract the disease. About 90 percent of 510 persons holding this belief had voluntarily obtained X-rays, a percentage about twice the percentage found among those who did not hold this belief.

Again, this is not at all irrational from the layman's point of view. To the medical profession, early detection means better prognosis or shorter, simpler therapy. But many people were found to worry less about prognosis or difficulty of treatment than about such things as losing their jobs and income, the shattering of their careers, or the financial burden on their families. Many of these people did not feel

that early detection of tuberculosis would do much to alleviate these problems. For them, detection of tuberculosis—early or late—may, with good reason, appear threatening rather than beneficial. They therefore tend to avoid being X-rayed.

In other words, people tend to obtain X-rays only if they feel that by early detection of tuberculosis those problems which they worry about can be avoided or at least considerably decreased.

Of particular interest in a study of why people obtain X-rays are those population groups among whom a relatively high tuberculosis prevalence has been reported but who often show very poor participation in screening programs. In this study, data for two of these groups, older males and people with low incomes, were analyzed.

It was found that the three factors described cut across socioeconomic classes and sex and age categories. That is, people who believe they might get tuberculosis, those who do not rely solely on symptoms as a stimulus for seeking X-rays, and those who see benefits for themselves in early detection of tuberculosis are likely to obtain X-rays voluntarily regardless of their economic status, their sex, or age. One thing that characterized the nonparticipating groups was that fewer persons in these groups held those beliefs.

### Knowledge and Action

In looking over these three factors, one may be tempted to conclude that many people still are not informed about tuberculosis and about the role of X-rays. But such a conclusion is not justified. What we are dealing with here is not merely a matter of information. It is a matter of real belief and of a conviction on the part of people that such information applies to them personally and that it is important to them as individuals.

Without question, a person must know what to do, when to do it, and how to do it before he can take action. But merely knowing these things will usually be insufficient to elicit the action to which they relate. Each of us keeps a storehouse of knowledge about things to do for our own health and welfare. But there is

a gap between having this knowledge and applying it in our own behavior. We learn to give the correct answers to questions long before we apply the information in voluntary action.

In view of these facts, it is not surprising that, although most people in the sample were able to give correct answers to direct informational questions, many of them still had never voluntarily applied this information by obtaining X-rays.

The following will illustrate this. During the interview, respondents were asked a direct informational question to see whether they knew that chest X-rays can detect the presence of tuberculosis before the patient becomes aware of outward symptoms of the disease.

Over 80 percent of the respondents were able to give correct answers to this question although many of them had never voluntarily obtained X-rays. Later in the interview, this subject was taken up again through a number of indirect, or projective, questions. These were designed to reveal beliefs and convictions, rather than merely factual information.

Analysis of the answers given to these projective questions yielded an interesting finding: Many of the respondents who had proved themselves fully informed concerning the fact that one can have tuberculosis without knowing it betrayed in their responses that they, to at least some degree, felt that they themselves would know if they had tuberculosis. Only about 35 percent of 543 such respondents had ever voluntarily obtained a chest X-ray without first noticing signs or symptoms of illness. Among those in whom this belief was especially strong, this percentage drops to about 20.

On the other hand, X-rays had been obtained voluntarily by 80 percent of the persons whose responses to the projective questions indicated that they believed fully that they themselves could have tuberculosis for a considerable period of time without knowing it.

### Conclusion

It should be emphasized again that this report deals with only three of the many factors that determine whether a person decides to obtain a chest X-ray and whether he follows up

his decision with appropriate action. Additional factors are being investigated in this study, and the results should further increase our understanding of the nature of voluntary health behavior.

To be of real value, however, the findings of

this study must be tested in actual practice under controlled conditions. Such coordination between research and program application is a must if research is to pay maximum dividends in ever-increasing sound health practices by the public.



## Pathological and Laboratory Services To Hospital Patients in Iowa

Of interest to hospital associations and administrators, as well as to physicians, pathologists, and laboratory technicians, is a recent decision by a district court of the State of Iowa, involving the provision of technological services to hospital patients. The case was that of *Iowa Hospital Assn., et al. v. Iowa State Board of Medical Examiners, et al.*, District Court, Polk County, decided November 28, 1955.

A group of some 30 nonprofit hospitals had brought an action for declaratory relief following the issuing of an opinion by the State attorney general. The major issue, as defined by the court, was whether "in purveying to patients . . . medical services in the form of laboratory procedures and X-ray procedures for compensation" the hospitals were engaged in "the illegal corporate practice of medicine."

The court ruled that they were so engaged and concluded, in addition, that under the practices described the pathologists or radiologists permitting a hospital to bill for medical services in the name of the hospital, without obtaining patient consent, violated the Iowa statute prohibiting fee splitting.

The Iowa State Hospital Association and the Iowa Medical Society were arrayed against each other in this litigation. The first joined with the hospitals as a plaintiff in the action, and the medical society intervened in behalf of the defendants which, in addition to the State

attorney general, included the Iowa State Board of Medical Examiners and the Iowa Association of Pathologists.

The arrangements for supplying pathological and laboratory services which had been practiced by the plaintiff hospitals and which the court condemned as violating the Iowa statutes are set out in detail in the court's findings. They were of long standing in the State and do not differ essentially from procedures commonly followed elsewhere. The opinion recognized that the facilities of pathology and X-ray laboratories are essential parts of a modern hospital that the plaintiff hospitals could continue to maintain. Further, it expressed the belief that the supplying of such services could be worked out "on the local level and within the law." The extent and nature of the required adjustment, however, were not spelled out in the opinion although changes by the hospitals in contractual arrangement with those providing services and with the patients would seem indicated.

The case has been appealed to the Supreme Court of Iowa. While the statutes involved are those of a particular State, the litigation is of unusual interest since this appears to be the first reported case in which nonprofit hospitals by such arrangements have been held in violation of medical practice acts.



*A review of the experience of the metropolis during the pre-war, war, and postwar periods points to the need for continuing control programs.*

# Venereal Disease Control in New York City

By THEODORE ROSENTHAL, M.D., and JULES E. VANDOW, M.D.

THE recent downward trends in the incidence and prevalence of venereal disease in New York City have been observed also in other parts of the United States (1-3). Confirmatory evidence from the autopsy table is provided by Bell (4), who found marked declines in mortality due to syphilis in the past two decades. Improved methods of diagnosis, treatment, public health education, and administrative control have undoubtedly contributed to this reduction of the venereal disease problem.

Previous reports (5-9) have described in detail the character of the New York City venereal disease control program and have presented statistical data on its progress. The present report completes this information through 1954, thus providing a continuing record from 1938.

## Early Control Activities

The historical background of the present venereal disease control program in New York City may be of interest. The first action in dealing with the venereal diseases as a public health problem in the city was initiated by

Biggs in 1912 (10). His program embraced the following pioneer steps:

1. Making syphilis and gonorrhea reportable diseases.

2. Offering diagnostic laboratory tests (including serologic tests for syphilis) for venereal disease to all physicians in the city without charge.

3. Advocating establishment by the health department of special clinics for diagnosis and treatment of venereal disease. (These clinics were for diagnosis and advice only. Five years later, in 1917, treatment was included in the services of the health department clinics also.)

4. Providing special hospital facilities for venereal disease cases.

5. Carrying on an educational campaign against patent nostrums and quackery in the field of venereal diseases. An attempt was made to follow Biggs' recommendations; inadequate staff prevented the full development of this forward-looking program for a score of years.

In 1935, a survey by the American Social Hygiene Association revealed the startling information that there were over 1 million men, women, and children in New York City suffering with syphilis or gonorrhea (378,000 with syphilis and 750,000 with gonorrhea), one-fifth of whom were infectious. The survey also revealed that 700 residents of New York City were being admitted annually to State hospitals for general paresis and other syphilis of the central nervous system.

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During the period 1912-35, venereal disease control in the New York City Department of Health was a responsibility of the bureau of preventable diseases. In 1935, based on the

survey and recommendations of the American Social Hygiene Association, a separate bureau of social hygiene was created to administer the venereal disease control program. Under a full-

**Table 1. Cases of syphilis reported in New York City, calendar years 1938-54**

Year	Esti- mated popula- tion in thou- sands	Number of cases									
		Total		Primary or secondary		Early latent <sup>1</sup>		Congenital		Other <sup>2</sup>	
		Num- ber	Rate <sup>3</sup>	Num- ber	Rate <sup>3</sup>	Num- ber	Rate <sup>3</sup>	Num- ber	Rate <sup>3</sup>	Num- ber	Rate <sup>3</sup>
1938.....	7,363	37,077	503.6	5,051	68.6	1,400	19.0	1,654	22.5	28,972	393.5
1939.....	7,416	32,874	443.3	3,411	46.0	2,054	27.7	1,467	19.8	25,942	349.8
1940.....	7,466	30,718	411.4	3,113	41.7	3,798	50.9	1,135	15.2	22,672	303.7
1941.....	7,510	27,194	362.1	2,957	39.4	4,720	62.8	966	12.9	18,551	247.0
1942.....	7,553	30,036	397.7	3,406	45.1	5,288	70.0	940	12.4	20,402	270.1
1943.....	7,597	25,878	340.6	4,252	56.0	5,551	73.1	651	8.6	15,424	203.0
1944.....	7,641	23,069	301.9	4,841	63.4	5,612	73.4	572	7.5	12,044	157.6
1945.....	7,684	22,690	295.3	5,164	67.2	6,162	80.2	583	7.6	10,781	140.3
1946.....	7,728	26,765	346.3	6,063	78.5	7,338	95.0	558	7.2	12,806	165.7
1947.....	7,772	26,303	338.4	5,009	64.4	6,610	85.0	566	7.3	14,118	181.7
1948.....	7,815	25,366	324.6	3,846	49.2	6,045	77.4	645	8.3	14,830	189.8
1949.....	7,859	20,489	260.7	2,218	28.2	4,479	57.0	533	6.8	13,259	168.7
1950.....	7,903	21,795	275.8	1,304	16.5	4,081	51.6	488	6.2	15,922	201.5
1951.....	8,042	22,458	279.2	801	10.0	3,461	43.0	545	6.8	17,651	219.5
1952.....	8,086	25,078	310.1	784	9.7	3,177	39.3	530	6.6	20,587	254.6
1953.....	8,078	25,224	312.2	658	8.1	2,637	32.6	456	5.6	21,473	265.8
1954.....	8,041	19,412	241.4	617	7.7	2,183	27.1	390	4.9	16,222	201.7

<sup>1</sup> Known as "other early syphilis" in 1938 and 1939.

<sup>2</sup> Includes late latent, late, and stage unknown.

<sup>3</sup> Per 100,000 population.

**Table 2. Cases of gonorrhea, chancroid, granuloma inguinale, lymphogranuloma venereum, and nonspecific urethritis reported in New York City, calendar years 1938-54**

Year	Esti- mated popula- tion in thou- sands	Gonorrhea		Chaneroid		Granuloma inguinale		Lympho- granuloma venereum		Nonspecific urethritis	
		Num- ber	Rate <sup>1</sup>	Num- ber	Rate <sup>1</sup>	Num- ber	Rate <sup>1</sup>	Num- ber	Rate <sup>1</sup>	Num- ber	Rate <sup>1</sup>
1938.....	7,363	12,935	175.7	164	2.2	-----	-----	242	3.3	-----	-----
1939.....	7,416	12,810	172.7	178	2.4	-----	-----	281	3.8	-----	-----
1940.....	7,466	14,639	196.1	288	3.9	55	0.7	258	3.5	-----	-----
1941.....	7,510	12,297	163.7	430	5.7	98	1.3	292	3.9	-----	-----
1942.....	7,553	12,032	159.3	529	7.0	97	1.3	242	3.2	-----	-----
1943.....	7,597	12,957	170.6	410	5.4	97	1.3	187	2.5	-----	-----
1944.....	7,641	14,489	189.6	310	4.1	145	1.9	202	2.6	-----	-----
1945.....	7,684	18,009	234.4	356	4.6	141	1.7	212	2.8	-----	-----
1946.....	7,728	24,350	315.1	522	6.8	161	2.1	233	3.0	-----	-----
1947.....	7,772	22,746	292.7	813	10.5	149	1.9	231	3.0	-----	-----
1948.....	7,815	23,422	299.7	562	7.2	170	2.2	224	2.9	-----	-----
1949.....	7,859	20,309	258.4	377	4.8	96	1.2	179	2.3	-----	-----
1950.....	7,903	16,784	212.4	221	2.8	78	1.0	172	2.2	-----	-----
1951.....	8,042	14,114	175.5	181	2.3	79	1.0	165	2.1	149	1.9
1952.....	8,086	12,105	149.7	194	2.4	50	.6	139	1.7	191	2.4
1953.....	8,078	12,505	154.8	255	3.2	45	.6	82	1.0	847	10.5
1954.....	8,041	12,379	153.9	159	2.0	37	.5	68	.8	1,238	15.4

<sup>1</sup> Per 100,000 population.

time bureau director, many of the recommendations made in the survey report were carried out. Among the most important were the following:

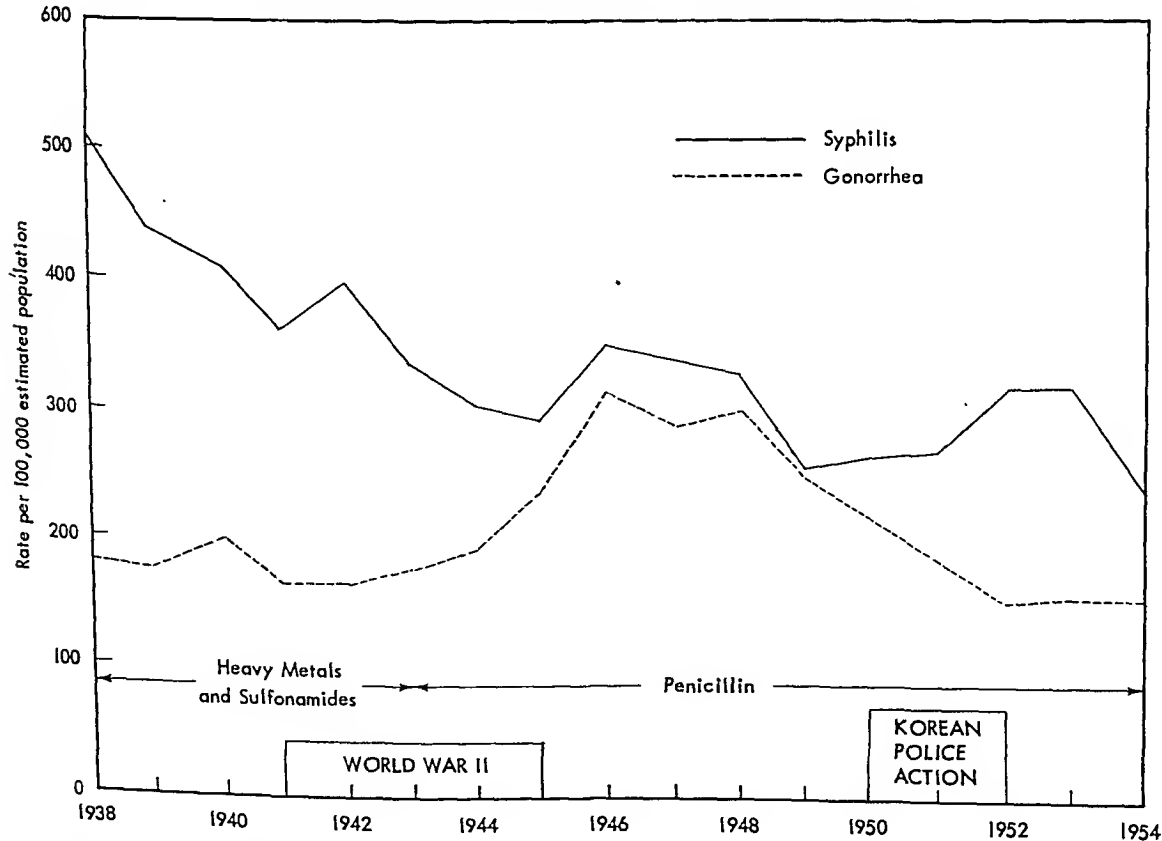
1. Increase of laboratory services to aid physicians in the diagnosis of persons infected with venereal diseases.
2. Establishment of a consultation service to advise practicing physicians in the handling of their venereal disease patients.
3. Expansion of case-finding and case-holding services.
4. Utilization of all available media to educate and inform the public as well as to provide technical instruction to physicians, nurses and others.
5. Improvement in reporting procedures.
6. Provision of free drugs to hospitals, clinics, and private physicians.
7. Cooperation with other departments of city, State, and Federal governments and with voluntary institutions and professional groups.

In addition, a comprehensive research program was carried out, including investigations on intensive treatment methods in early syphilis, evaluation of drugs in the treatment of syphilis, and fundamental studies in lymphogranuloma venereum and granuloma inguinale.

### Modern Control Program

Several years were required to familiarize physicians and personnel in hospitals, clinics, and laboratories with their basic responsibilities concerning morbidity reporting. For this reason, morbidity statistics for the venereal diseases prior to 1938 are not completely reliable; as a matter of fact, syphilis cases were tabulated merely on the basis of positive serologic reactions in the laboratories of the health department. Since 1938, however, the morbidity reporting system has been on an efficient and reliable basis, eliminating to as great an extent as possible all duplications. Specially trained

Figure 1. Newly reported syphilis and gonorrhea cases, New York City, 1938-54.



physicians have been available since 1935 to consult with practitioners throughout the city on any phase of their venereal disease problems. This has tended to improve accuracy and completeness in reporting.

Local public health regulations contained in section 88 of the New York City sanitary code, supplemented by article 17B of the New York State public health law, provide for control of infected persons, morbidity reporting by physicians and institutions, and reporting of positive laboratory findings by clinical laboratories.

#### *The Prewar Period, 1938-41*

Tables 1 and 2 present in detail the number of reported cases and rates per 100,000 population for each venereal disease reported in New York City during the period 1938-54. The year 1938 marks the first year that these data may be considered to be reliable. In that year, 37,077 cases of syphilis were reported, a rate of 503.6 per 100,000. In the same year, almost 13,000 cases

of gonorrhea were reported, representing a rate of 175.7 per 100,000.

From 1938 to 1941, the number of reported cases of syphilis steadily declined to 27,194, the rate falling to 362.1 per 100,000. There had been close cooperation with the Selective Service System for distribution of social hygiene literature to prospective registrants. Educational activities had been increased throughout the city and every possible aid, such as films, lantern slides, posters, and pamphlets, had been made available to the various military installations located within the city.

Syphilis was declining in New York City at a fairly rapid rate even before the advent of penicillin. It is felt that this decline resulted from the comprehensive control measures that had been in effect since 1935. Primary and secondary syphilis declined almost 50 percent in this same period.

During this period, there was little change in the reported number of cases of gonorrhea.

**Figure 2. Syphilis cases, by stage of disease, New York City, 1938-54.**

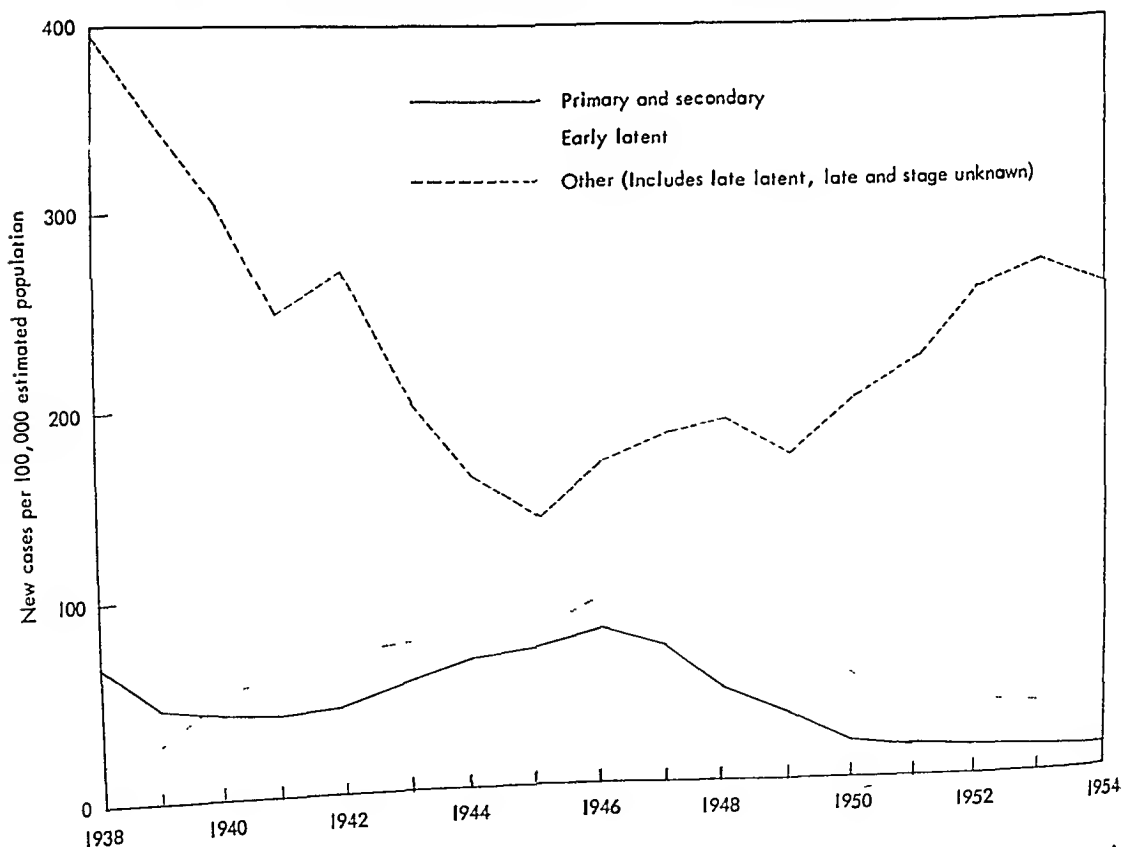
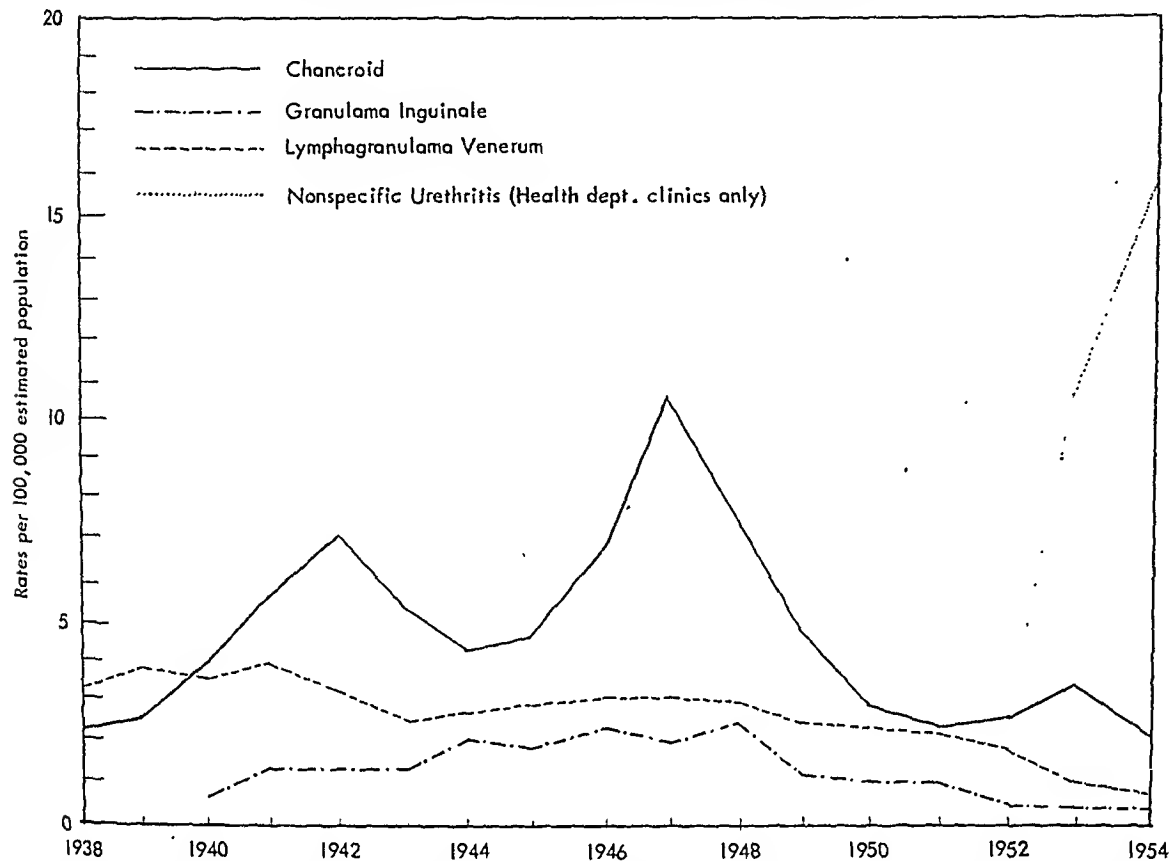


Figure 3. Newly reported cases of chancroid, granuloma inguinale, lymphogranuloma venereum, and nonspecific urethritis, New York City, 1938-54.



Apparently control measures that were effective against syphilis had little effect against gonorrhea. The same could also be said for chancroid since this disease appeared to be increasing steadily each year so that, in 1941, the rate was 5.7 per 100,000, more than two and one-half times higher than in 1938.

It may be concluded, nevertheless, that the expanded venereal disease control program that was put into effect in 1935 was an important factor in preventing a rise in the incidence of syphilis and gonorrhea during the period of military and industrial mobilization just preceding the actual outbreak of World War II.

#### *The War Period, 1941-45*

With the country engaged in a global war, the problems of venereal disease control were multiplied enormously. Because New York City is a great seaport and railroad center, it became an important point of embarkation for

millions of soldiers. Soldiers and sailors flocked to the city nightly from the many nearby military installations. Industrial workers poured into the city by the thousands, attracted by the expanded industrial activity.

Close cooperation was maintained by the city with each branch of the military service. The Armed Forces Disciplinary Control Board was created at this time to secure even closer cooperation with civilian agencies charged with control of prostitution, sale of alcoholic beverages, and related matters. Reported venereal disease contacts of members of the armed forces who had allegedly been infected in the New York area were over 10,000 each year. Every effort was made to locate and secure the medical examination of the persons named as contacts (11), and approximately 60 percent of these were located.

During the war period, primary and secondary syphilis increased over 40 percent and early

**Table 3. Number and percentage of reported cases of syphilis and gonorrhea, by reporting agency, 1940-54**

Year	Syphilis							Gonorrhea						
	Total	Private physician		Health department clinics		Other		Total	Private physician		Health department clinics		Other	
		Number	Percent	Number	Percent	Number	Percent		Number	Percent	Number	Percent	Number	Percent
1940-----	30,718	11,274	36.7	12,136	39.5	7,308	23.8	14,639	3,092	21.1	6,248	42.7	5,299	36.2
1941-----	27,194	10,226	37.6	9,729	35.8	7,239	26.6	12,297	2,700	22.0	4,413	35.9	5,184	42.1
1942-----	30,034	11,638	38.7	9,566	31.9	8,830	29.4	12,023	2,095	17.4	4,762	39.6	5,166	43.0
1943-----	25,878	10,068	38.9	8,293	32.1	7,517	29.0	12,957	1,533	11.9	6,004	46.3	5,420	41.8
1944-----	23,069	9,653	41.8	5,631	24.4	7,785	33.8	14,489	2,104	14.5	6,904	47.6	5,481	37.9
1945-----	22,690	9,705	42.8	5,171	22.8	7,814	34.4	18,011	2,703	15.0	9,249	51.4	6,059	33.6
1946-----	26,765	10,212	38.2	7,538	28.1	9,015	33.7	24,350	2,894	11.9	15,073	61.9	6,383	26.2
1947-----	26,303	11,355	43.2	6,940	26.4	8,008	30.4	22,746	2,321	10.2	15,924	70.0	4,501	19.8
1948-----	25,366	11,531	45.5	6,273	24.7	7,562	29.8	23,422	2,991	12.8	15,079	64.4	5,352	22.8
1949-----	20,489	8,061	39.3	5,776	28.2	6,652	32.5	20,309	2,736	13.5	13,954	68.7	3,619	17.8
1950-----	21,795	8,198	37.6	4,987	22.9	8,610	39.5	16,784	2,369	14.1	11,570	68.9	2,845	17.0
1951-----	22,458	9,384	41.8	4,244	18.9	8,830	39.3	14,114	2,763	19.6	8,778	62.2	2,573	18.2
1952-----	25,078	10,607	42.3	3,489	13.9	10,982	43.8	12,105	2,280	18.8	7,332	60.6	2,493	20.6
1953-----	25,224	9,658	38.3	4,792	19.0	10,774	42.7	12,505	2,681	21.4	7,464	59.7	2,360	18.9
1954-----	19,412	7,816	40.3	2,626	13.5	8,970	46.2	12,381	1,476	11.9	8,446	68.2	2,459	19.9

latent syphilis increased over 20 percent. Tabulation of morbidity reports indicated early that syphilis was increasing, particularly in the younger age groups. Because of this, control measures were intensified (11). Gonorrhea rates also rose steeply, increasing from 163.7 in 1941 to 234.4 in 1945. The sulfonamides were being used for treatment; penicillin, though known to be effective, was in short supply and was reserved almost exclusively for the armed forces.

#### *The Postwar Period, 1946-54*

Following the close of the war, reports of communicable syphilis and gonorrhea continued to mount until peak levels for these diseases were reached in 1946. Since then, there has been a steady drop in reported cases. Some of the important reasons for this falling incidence are utilization of penicillin and other antibiotics, improvements in diagnostic procedures, and intensification of public health control activities. It was fortunate that at this time penicillin became freely available for civilian use. Its value against both syphilis and gonorrhea had already been well demonstrated by a number of studies in military and civilian institutions.

Improvements in laboratory procedures, such as the development of cardiolipin antigen and quantitative tests resulted in more accurate serologic tests for syphilis and better evalua-

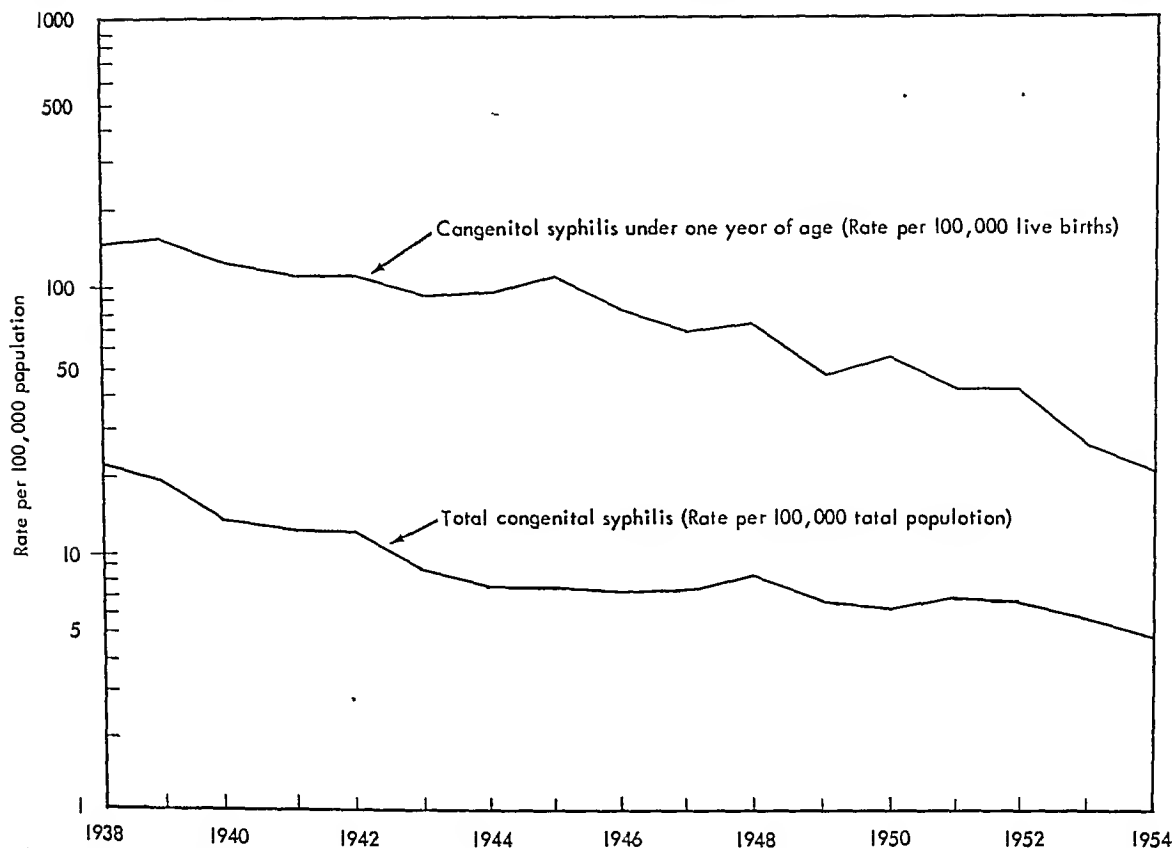
**Table 4. Newly reported cases of congenital syphilis, New York City, 1938-54**

Year	All ages <sup>1</sup>		Cases under 1 year	
	Number	Rate per 100,000 population	Number	Rate per 100,000 population
1938-----	1,654	22.5	159	162.0
1939-----	1,467	19.8	169	171.6
1940-----	1,135	15.2	141	136.2
1941-----	966	12.9	125	112.8
1942-----	940	12.4	144	112.3
1943-----	651	8.6	120	92.0
1944-----	472	7.5	116	97.5
1945-----	583	7.6	139	111.3
1946-----	558	7.2	123	82.8
1947-----	566	7.3	116	69.6
1948-----	645	8.3	115	74.8
1949-----	533	6.8	72	47.1
1950-----	488	6.2	85	55.9
1951-----	545	6.8	66	41.5
1952-----	530	6.6	67	41.8
1953-----	455	5.6	43	27.3
1954-----	390	4.9	33	20.6

<sup>1</sup> Includes age unknown.

NOTE: All cases of congenital syphilis are investigated for accuracy of diagnosis.

Figure 4. Congenital syphilis cases, total and under 1 year of age, New York City, 1938-54.



tion of the effectiveness of treatment. Improved culture methods were valuable in the diagnosis of gonorrhea, especially in females.

#### Discussion

A general picture of the reported cases of the venereal diseases in the period 1938-54 may be obtained from figures 1-3. There was little change in the rates for newly reported cases of gonorrhea until 1942, when the rate began to climb slowly. After 1944, a sharp increase occurred, reaching a peak in 1946 about twice as high as that of 1942. For 2 years, until 1948, this high level was maintained. Then, for the next 4 years, the rate steadily fell until in 1952 it was back to about the 1942 level, where it has hovered ever since.

The total number of syphilis cases fell from a rate of 503 in 1938 to 295 in 1945. The fall was steady except for a moderate increase in 1942, when many latent cases were being discovered by medical examination of draftees.

Another increase occurred in 1946 but this was mainly due to an increase in early syphilis cases after the war. Again, the total syphilis figure began to decline, reflecting a decrease in primary, secondary, and early latent syphilis. After 1949, the rate for total syphilis again rose steadily, reaching a plateau in 1952-53. This last increase was due entirely to steadily increasing reports of late latent syphilis which overshadowed the decreasing reports of infectious cases. In 1954, for the first time since 1945, late and late latent syphilis reports fell sharply, producing a decided drop in the total syphilis rates from about 312 in 1953 to 241 in 1954.

The relationships of the various stages of syphilis to each other are better seen in figure 2. From a rate of 68.6 in 1938, primary and secondary syphilis fell to a rate of 39.4 in 1941. These cases then increased each year throughout the war into the postwar year 1946, when they reached their peak, a rate of 78.5. Since

this high point, the incidence has fallen each year during the succeeding 8 years. As the chart reveals, the descending curve has almost flattened out over the past 4 years. Nevertheless, the rate of 7.7 in 1954 is less than half the 1950 rate of 16.5.

The curve for early latent syphilis almost exactly parallels that of primary and secondary syphilis from 1940 to 1954, except that the rates for early latent syphilis run at a slightly higher level than those for primary and secondary syphilis. No attention should be paid to the 1938-40 rates for early latent syphilis, since during this period early latent syphilis was referred to as early syphilis and included only latent cases of less than 1 year's duration. Undoubtedly, if cases up to 4 years' duration had been included in this diagnosis, in accordance with accepted practice since 1940, the curve from 1938 to 1940 would be higher than that indicated in the chart.

Except for the year 1942, when there was a slight increase, "other" syphilis (which includes late latent, late, and stage unknown) dropped precipitously from a rate of 393.5 in 1938 to 140.3 in 1945. Thereafter, it rose steadily to a high point of 265.8 in 1953. A "mass street survey" in 1953 uncovered many cases of late latent syphilis, which helped to push the rate up to the highest level recorded since 1942. Many of these cases undoubtedly were acquired during the war years. In 1954, more than 5,000 fewer cases of late and late latent syphilis were reported than in 1953, the rate falling to 201.7.

Table 3 indicates the number of cases of syphilis and gonorrhea reported annually from each of the three reporting sources during 1940-54. Also indicated are the percentages of the total number of syphilis and gonorrhea case reports received annually from these reporting sources.

Figure 3 shows the rates for the minor venereal diseases, and indicates the postwar peak for these diseases.

Nonspecific urethritis is not reportable in New York City. In 1951, because of the relative increase of cases, it was decided to admit and treat these patients in health department clinics. Figure 3, therefore, by no means reveals the true incidence of this disease, since the rate refers only to patients admitted by health de-

partment clinics. In 1953, nonspecific urethritis made up 11.2 percent of the total number of cases of urethritis in males seen in these clinics, which, in 1954, was 15.3 percent of such cases.

In 1938, 1,654 cases of congenital syphilis in all ages were reported; 159 were under 1 year of age. There has been a gradual decline since that time so that in 1954, 390 cases of all ages were reported, with only 33 under 1 year of age (table 4 and fig. 4).

A parallel picture is seen in syphilis of the central nervous system. A tabulation of admissions of New York City residents to State mental hospitals for syphilis of the central nervous system shows a gradual decline. In 1933, 732 cases were admitted; a progressive reduction in numbers ensued each year, with 167 being admitted in 1953 (table 5).

Another index of the decline in venereal disease prevalence is furnished by the records of the Women's Court, where all women arrested on charges of prostitution are examined for venereal disease.

**Table 5. First admissions from New York City to New York State civil hospitals diagnosed as syphilis of the central nervous system, fiscal years 1933-53**

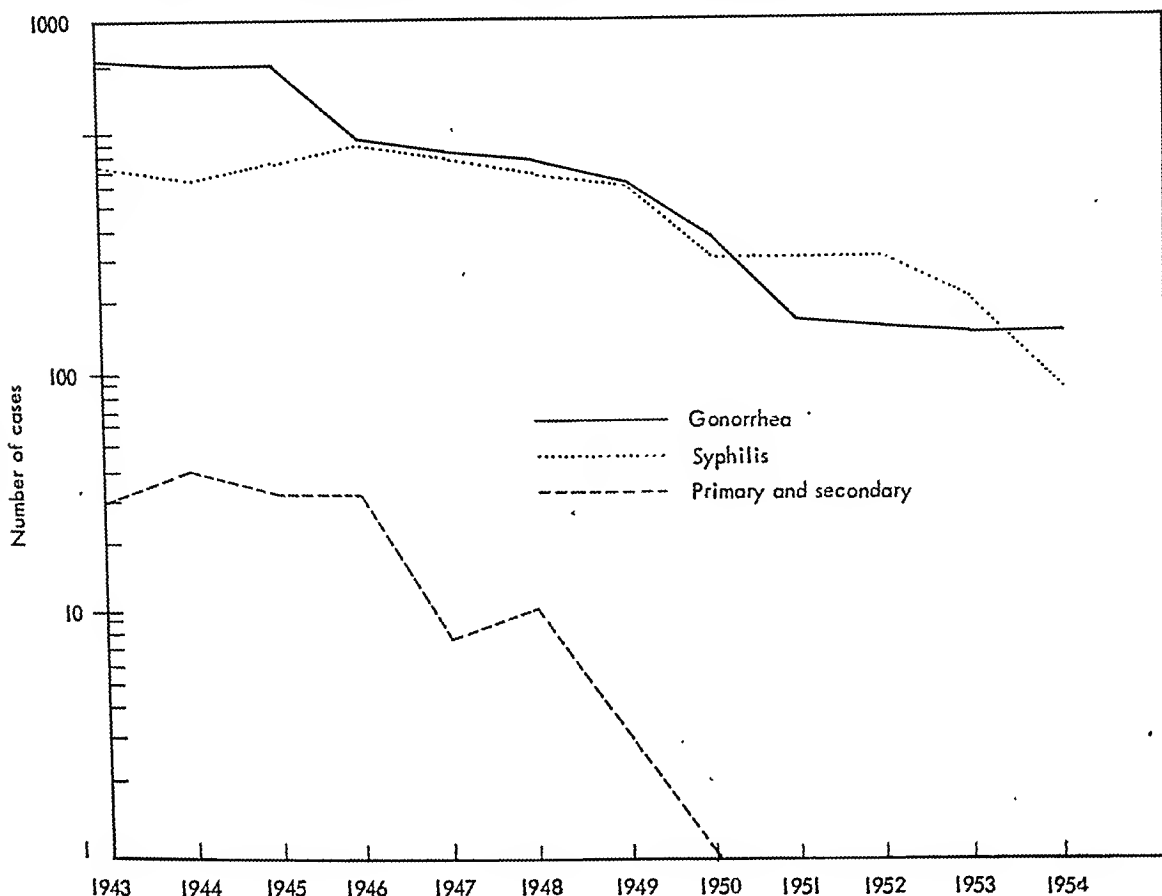
Fiscal year	General paresis and other syphilis of the central nervous system		
	Males	Females	Total
1933.....	579	153	732
1934.....	497	160	657
1935.....	551	159	710
1936.....	528	179	707
1937.....	566	183	749
1938.....	537	167	704
1939.....	561	186	747
1940.....	493	159	652
1941.....	473	186	659
1942.....	426	140	566
1943.....	309	104	413
1944.....	345	121	466
1945.....	333	140	463
1946.....	278	106	384
1947.....	270	107	377
1948.....	274	98	372
1949.....	215	85	300
1950.....	205	117	322
1951.....	192	79	271
1952.....	134	82	216
1953.....	98	69	167

<sup>1</sup> 9 months.

SOURCE: New York State Department of Mental Hygiene.



Figure 5. Number of cases of primary and secondary syphilis, all syphilis, and gonorrhea diagnosed in all women coming to the Women's Court, New York City, 1943-54.



A glance at figure 5 reveals the progressive decline in both syphilis and gonorrhea. In 1943, 34.8 percent of the women arrested were found infected with gonorrhea and 15.8 percent with syphilis. In 1954, 5.5 percent had gonorrhea, whereas only 3.4 percent were found to have syphilis (table 6).

The changing trends in case reporting, as seen in table 1, are produced by such conditions as the marked decline in lesion syphilis, the increase in latent syphilis, and the increasing use by the private practitioner of such effective remedies as penicillin and other antibiotics. In the diagnosis of syphilis, the laboratory plays a vital role. All laboratories in the city are required to report positive findings to the health department. This is an important factor in the completeness of syphilis morbidity reporting. Unfortunately, the laboratory is not uti-

Table 6. Venereal disease among women examined in Women's Court, New York, N. Y., 1943-54

Year	Number examined	Percent infected		
		Syphilis	Syphilis and gonorrhea	Gonorrhea
1943	4,595	10.0	5.8	29.0
1944	4,448	9.1	5.5	28.4
1945	4,814	9.4	6.5	25.7
1946	4,038	14.7	6.6	16.9
1947	3,588	14.8	5.9	18.6
1948	3,685	12.9	4.2	17.5
1949	3,269	13.1	2.8	13.6
1950	2,999	8.3	1.2	10.8
1951	2,681	9.8	.6	5.3
1952	2,268	11.0	.8	5.9
1953	2,306	7.1	.3	5.8
1954	2,448	2.9	.2	5.6

lized to the same extent for the diagnosis of gonorrhea, a fact which helps to explain the paucity of gonorrhea morbidity reports from private practitioners.

### Conclusions

Reductions in reported cases of early syphilis, gonorrhea, and other venereal diseases have occurred in New York City since the end of World War II. Our public health control programs have skillfully combined community resources to include in our venereal disease combat teams the private practitioner of medicine; personnel of hospitals and clinics; educational institutions; social and welfare agencies; the voluntary organizations, such as the New York Tuberculosis and Health Association, Inc., and the American Social Hygiene Association; the clergy; and the Armed Forces, coordinated by the official health agencies and with, above all, an informed public.

Further reductions in venereal disease incidence will be difficult to achieve in an area such as New York City, which is not only a focal point for traffic from all parts of the United States but, in addition, is a global seaport and airport. Population movement from within the country, coupled with the increasing international traffic into the area, constitute problems beyond any local public health control.

These and other special problems peculiar to a great metropolis point to the necessity for

maintaining a vigorous program for the continued control of venereal disease.

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# A Pre-Administration Curriculum in a School of Public Health

By KEITH O. TAYLOR, M.B.A.

WE ARE currently faced with the need for well-qualified administrators in the health fields. The selection of persons for such positions is difficult. The hospital field, in particular, has only in fairly recent years established graduate training for persons desirous of entering this field. The first course in hospital administration was started at the University of Chicago in 1934, but there are now 13 courses in schools with membership in the Association of University Programs in Hospital Administration.

The hospital field had the advantage of a major study of problems of hospital administration and university curriculums to meet the needs in this field. The initial major study was conducted from 1945 to 1948 by a Joint Commission on Education with Charles E. Prall as director. This study was sponsored by the American College of Hospital Administrators and the American Hospital Association and received financial support from the Kellogg Foundation. The final reports were issued in 1948 and helped to focus attention on areas which required emphasis in the academic and preceptorship periods. One subsequent study

and review has already been undertaken in this field.

## Basic Recommendations

The Prall study (1), although it did not give major attention to undergraduate preparation for those desiring to enter the graduate field, did make certain rather general recommendations. It suggested that extensive specialization at the undergraduate level is probably neither necessary nor wise and that a student should aim toward a well-rounded general education. But the recommendation goes on to say that "the idea of a broad basic education should not be confused with an excessive scattering of effort." More specifically, the report says:

"Students who are completing requirements for their first degree often ask what work will be most useful if later they seek admission to the courses in hospital administration. A complete answer to this question requires knowledge of the individual's past training, special qualifications, and job experience. What is offered here must, therefore, be considered in the nature of general guidance.

"If the student is not completing a major in the social studies or psychology, one or more senior college courses in each of the following should be suggested: economics, sociology or government, psychology. If he has had only the minimum requirement in science, some ad-

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*Mr. Taylor has been associate director of the course in hospital administration of the University of California School of Public Health, Berkeley, since 1950.*

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vanced work in either the biological or the physical sciences would prove to be valuable. There are circumstances, of course, where a new beginning might be preferable. The individual who has had no recent contact with chemistry or biology is a case in point. A try-out in statistics, if not restricted by prerequisites, and a course in introductory accounting should be included. The last-named is the only subject mentioned thus far as a requirement for admission."

The more recent Olsen report (2) gives added emphasis to the need for more basic preparation in the field of business but, like the Prall report, notes the importance of a well-rounded general education. To the extent to which these prerequisite ideas are correct, it is apparent that such a program might be based in any of several schools, liberal arts, sociology, business administration, to mention a few. It is, however, essential that whatever school is chosen it provide adequate flexibility.

### **Flexibility in Planning**

At the University of California, a program of this nature has been developed in the School of Public Health. The school provides an upper division curriculum. The need for drawing on many interdepartmental disciplines to supplement the fields of major concentration makes flexibility a basic element in the school's curriculum planning.

There was little difficulty, therefore, in establishing a pre-administration program of reasonable breadth, one that could be rather readily tailored to the needs of students who had completed an associate of arts or its equivalent at the college level in their first 2 years.

Some courses at the lower division level are recommended toward advanced work which the student takes after admission to the School of Public Health, but in practically all cases any student entering at the junior year can complete the remaining lower division prerequisites and the upper division requirements within 2 years. Prerequisites include at least 9 units from the social sciences; 12 from the humanities, English, and speech; and a basic biological science, beginning accounting, and a

survey course of the health fields. When possible, a basic law course is recommended at the lower division level. Emphasis at the undergraduate level for the relatively few students who indicate an interest as early as their freshman year is toward a broad educational background and one which will allow them a maximum diversity of selection by the time they are ready finally to choose their upper division school since by that time some students will have found interest in other directions.

### **Admission Requirements**

Selection for admission at the upper division level in hospital pre-administration is rather stringent. All students who apply are interviewed at considerable length by a full-time faculty member of the graduate course in hospital administration and are then referred to the university counseling service for testing and counseling interviews.

Students are normally referred to a local hospital administrator for further interview and assigned brief readings in the field. There are a number of reasons for lengthy consideration at this point. Many students, whether correctly or incorrectly, wish their degree in a major in which the undergraduate degree in itself will provide an entree to specific job situations. The pre-administration major and the bachelor of science degree provide an essentially broad background and not a degree acceptable to hospitals for positions in the field of hospital administration. This is also largely true of alternate selections in the upper division in the areas of public health and medical care pre-administration.

Students who wish to enter the field of hospital administration, therefore, must be prepared to maintain an adequate grade average for acceptance by a graduate school and, in the case of the University of California, must plan on a 3-year program beyond the baccalaureate in order to complete the requirements. Students, moreover, must be provided with the facts that placement in this field, while good, means willingness to go wherever positions are available and that progression in the field requires a continuing growth of the individual over a fairly long period. The rapid changes

in hospitals and related health groups in the last 20 years, the continuing technical, economic, and human relations changes now in process call for administration with breadth and flexibility.

This means that emphasis must be placed on the fact that a considerable measure of the individual's success will depend on his own ability to prove ultimately his leadership qualities. Education can provide stimulus for the individual, provoke curiosity, and give a student the base on which to build, but education cannot provide a garment of facts and techniques in which the graduate goes forth cloaked as a leader. Although the standards established for admission do not lead to a large undergraduate body, there has been a fairly steady growth of applicants.

Because of its flexibility, the course may be used, as far as the senior year, in an alternate position with other courses not only in public health but also in premedical and other fields.

### Course Requirements

The usual course for the person who has selected pre-administration in his junior year includes some 44 units of selected work in the following areas: advanced psychology (usually human relations), cultural anthropology, principles of organization and management, personnel administration, managerial accounting, industrial relations, advanced economics, biostatistics, community health education, sanitation, introduction to health administration, medical sociology and medical background, and disease control. As this leaves the student a minimum of 14 additional units, other work may be selected to fit the needs or special interest of the student. Only three units of work are devoted specifically to the hospital. These are in the form of a survey course which is also taken by students from several other areas. The various types of institutions—voluntary and governmental, general, chronic, and mental—are presented in terms of their relationships to the community and to one another, as well as in the individual setting. A major objective of the survey course has been to portray the complex nature of the hospital as an institution, the kinds of problems which it faces, and the

many interrelationships with which it is concerned.

### Preceptorships

Graduate students who have shown ability in their academic work and appear otherwise personally qualified are referred to the hospital administrators who have agreed to establish special preceptorships. In a very few cases carefully selected students from other schools, who have a reasonably equivalent pre-administration background, are also referred. Some students who have graduated in other fields take an extra year of graduate work prior to the internship to make up for deficiencies. This graduate year somewhat parallels the upper division pre-administration work, and these students have then entered the preceptorship on the same basis as the regular pre-administration graduate.

The preceptorship, or administrative internship, is not dissimilar to the well-established administrative residency required in all graduate courses in hospital administration. The main difference lies in the longer period of orientation to the hospital, its departments, and related activities, the somewhat more restricted degree of responsibility placed on the student in administrative situations, and the higher demands on the administrator in terms of teaching interest.

This year of education within the hospital is clearly reflected in seminar discussion and special study during the graduate academic year. Students with this background compare favorably with others whose experience in the field may have been much longer. They not only contribute to classes, but, on the basis of actual experience, are able to derive far more from case and discussion sessions at graduate level than is possible with students lacking an experiential background. Moreover, students with a minimum 2-year background following a bachelor's degree are able to enter the administrative residency with a fairly high level of preparation.

### Results

The pre-administration program has been in existence only 7 years, and students have gradu-

ated from this program only in the last 5 years. Of 27 students taking their bachelor's degree in this area, 18 have continued with the advanced program, one of whom completed his graduate study at an eastern university. Fifteen students have now completed both the undergraduate program and the preparation requirement. Of that number, 8 have also completed residencies and taken appointments in the field. The rest of the 15 are either entering into residencies or the graduate academic program during the current year. Four more of the 27 graduates are now in administrative internships.

At the undergraduate level some 10 students are currently following the pre-administrative program on the Berkeley campus. Several are enrolled in a similar pre-administration program at the University of California at Los Angeles. In the past few years, a number of students who completed basically similar undergraduate programs in other schools have been placed in internships.

None of us associated with the graduate course feel that the undergraduate program outlined here is the only pattern for development of future students in administration for health fields. We do believe that the combination of social sciences, biological sciences, the humanities, and business administration, together with some background knowledge of

the health fields, is essential for a progression such as we have outlined. Such a preparatory program, however, is possible within the structure of many schools and without undue concentration by the student. Administration provides an alternate field for capable students in premedical, business administration, and several other areas. Although the field of hospital administration, itself, provides only a limited number of positions, there are at present some 200 students a year entering graduate work in this field alone, and graduates are also taking positions in allied health fields.

Careful selection and guidance of college students with real aptitude and ability can, we believe, help to attract outstanding students to the fields of health administration. Our experience with the progress of students, even though the program is still relatively new, has been encouraging to us and has proved acceptable to students, preceptors, and faculty alike.

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### Project to Combat Tuberculosis in Indians

A 3-year program to reduce tuberculosis among southwestern Indians will be conducted by the Phipps Institute of the University of Pennsylvania under contract with the Public Health Service.

The tuberculosis incidence is about nine times higher among Indians than among the non-Indian population of the United States. The institute will conduct field studies and administer drugs to assist in the prevention and treatment of the disease in about 8,700 children.

Affected by the plan will be the United Pueblos and the Jicarilla and Mescalero Apaches of New Mexico and the Consolidated Utes of Colorado. If techniques prove successful, they will be extended to other areas.

# Poliomyelitis Survey in Rio de Janeiro

By MAURICIO MARTINS da SILVA, M.D., and JEROME T. SYVERTON, M.D.

**C**LINICALLY recognizable poliomyelitis was accepted in Brazil as an endemic disease of sporadic occurrence until 1953. Rio de Janeiro with a population of 2,626,875 had 25 reported cases per year from 1949 to 1952, an attack rate of 0.9 per 100,000 and a case-fatality rate of 20 percent (1). The disease occurred evenly throughout the year with perhaps a slight increase in incidence during the summer months of November, December, and January.

In 1953, the impact of a severe epidemic alerted physicians and health authorities. A total of 746 cases were reported from Rio de Janeiro. Of these patients, 561 were classified as residents and 185 as nonresidents. The nonresidents were patients from neighboring states who came to Rio de Janeiro for medical treatment. The result for this single year was a

resident attack rate of 21.5 per 100,000 and a case-fatality rate of 4.6 percent.

In 1954, the disease again assumed epidemic proportions with a recorded total of 356 patients (245 residents and 111 nonresidents). The resident attack rate was 9.3 per 100,000 and the case-fatality rate, 4.2 percent. The epidemic curves for the 2 years are shown in the figure. The analysis of the 1954 data showed that 91.8 percent of the cases occurred in children under 5 years old (83.6 percent under 3 years) and no cases were seen in persons over 40 years of age. It further showed that a larger percentage of cases (60 to 70 percent) came from higher than average socioeconomic groups as determined by the type of residency, sanitary installations, and race (67.7 percent white, 32.3 percent nonwhite).

Prior to 1953, the only other recent epidemic of poliomyelitis in Rio de Janeiro was in 1939. Then 287 cases were recorded.

In other tropical and subtropical countries and in areas of the world where standards of hygiene are generally poor, exposure to the poliomyelitis viruses and the consequent development of antibodies occur almost universally and at an earlier age than in communities in which hygienic standards are higher (2-9). Crowded conditions and frequent pollution of the environment facilitate the spread of any disease in which the etiological agent is present in the oropharynx and stools (8).

Serologic evidence of the extent of poliomyelitis infection in the general population of Brazil is limited to a single study reported in 1937 by Hudson and Lennette (10). These workers examined serum samples from 10

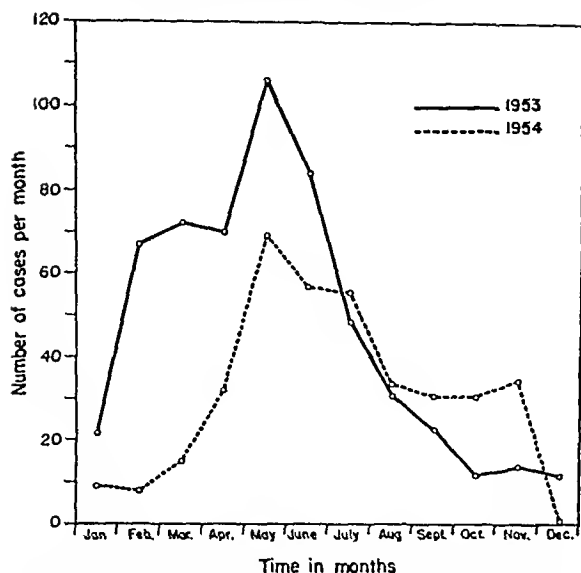
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*Dr. Martins da Silva, currently on leave as head of the third pediatric service, Sao Zacharias Hospital of Rio de Janeiro, is research associate in the department of bacteriology and immunology and assistant professor of pediatrics, University of Minnesota. Dr. Syvertson is professor and head of the department and consultant to the Surgeon General of the Public Health Service (Microbiology Study Section). This study was aided by a grant from the National Foundation for Infantile Paralysis.*

*Dr. Waldir Cordeiro de Moraes and Dr. Helio Lopes da Costa, members of the staff of the third pediatric service, Sao Zacharias Hospital, obtained the samples, and Companhia Harkson Industria Comercio Kibon and Pan American World Airways provided air transportation of these samples.*

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# **Poliomyelitis incidence by month in Rio de Janeiro, Brazil, 1953-54**



Courtesy of Dr. Aristides Paes de Almeida, epidemiology service, Department of Hygiene, Rio de Janeiro, D. F., Brazil.

Brazilians ranging in age from 10 to 30 years. They resided in the town of Formosa in the State of Bahia, Brazil. The method for assay of neutralizing poliomyelitis antibodies was qualitative by present-day standards; the MV strain of virus (11) used in the study presumably was poliomyelitis virus, type 2 (Lansing). This study revealed that 8 out of the 10 persons had neutralizing antibodies for MV virus. In 1937, epidemics of poliomyelitis were not known in Bahia, and only a few deaths were reported from scattered parts of Brazil.

This study was undertaken to learn from serologic evidence the extent of previous poliomyelitis infections in Rio de Janeiro and thereby provide information helpful to an understanding of the recent epidemic outbreaks in Brazil and of the global epidemiology of poliomyelitis.

## **Materials and Methods**

Blood samples from 111 persons of 3 representative socioeconomic groups in Rio de Janeiro and its environs were collected in July and August 1954. An attempt was made to obtain donors, aged 6 or 7 years, for a comparative study of antibody patterns in a similar age group in the United States. In group A

two-thirds of the children resided in slum areas located on the hills of the city and one-third were from a semirural grade school of the Federal District. Overcrowding, lack of minimal sanitary facilities (no sewage disposal or running water) characterized the environment of group A. Group B children were city dwellers living in small houses or apartments where sanitary and hygienic standards, as determined by running water, sewage disposal, adequate income, and no overcrowding, were greatly superior to those of the previous group. Group C included children from the upper income brackets, both Brazilian and foreign residents. Their standards of hygiene were as high as those of the Americans in groups D and E (12), consisting of children of University of Minnesota faculty members and University of Minnesota medical students, respectively (authors' unpublished experiments).

The sample of blood (about 10 ml.) was withdrawn aseptically without anticoagulant. Serum was separated from the clot within 24 hours and kept sealed in glass vials at refrigerating temperatures (2° to 10° C.). Quantitative assay for neutralizing antibodies in the serums was effected through use of HeLa cell cultures by the procedures employed routinely in this laboratory (14). This strain of HeLa cells has been maintained in continuous culture on glass in the laboratory since May 31, 1951.

**Table 1. Distribution by immunotype and titer of poliomyelitis antibodies among three different socioeconomic groups in Brazil**

Serum titer	Type 1			Type 2			Type 3		
	A	B	C	A	B	C	A	B	C
4,096 or more	1	1	0	3	5	1	0	2	3
1,024	3	10	3	5	12	3	4	8	1
256	7	14	6	9	8	6	6	8	1
64	11	9	4	8	9	4	9	13	1
16	5	9	2	3	9	1	4	8	2
4	1	2	1	0	2	3	1	2	2
0	1	13	8	1	13	6	5	17	14

A=Low socioeconomic group, urban and semirural (29 individuals).

B=Average socioeconomic group, urban (58 individuals).

C=High socioeconomic group, urban (24 individuals).



**Table 2. Percentage distribution of poliomyelitis antibody by immunotype among different socioeconomic groups in Brazil and in the United States**

Group	Number	Average age	Percentage with antibody to:			
			No type	Single type	2 types	3 types
A-----	29	8.6	0	3.4	17.2	79.4
B-----	58	11.8	3.4	20.6	22.4	53.4
C-----	24	18.3	4.2	29.1	37.5	29.1
D-----	26	6.5	30.7	23.1	30.7	15.4
E-----	43	20-30	20.9	41.8	20.9	16.2

A=Low socioeconomic group, urban and semirural.

B=Average socioeconomic group, urban.

C=High socioeconomic group, urban.

D=Children of University of Minnesota faculty members (5-10 years).

E=University of Minnesota medical students.

Serums were inactivated for 30 minutes at 56° C. and diluted in BSS (Hanks' balanced salt solution) medium with antibiotics and a fungicide to give fourfold dilutions ranging from 1:4 to 1:4096 (6 tubes/serum/type). One hundred TCID<sub>50</sub> (tissue culture infectious dose) of poliomyelitis virus, type 1 (Mahoney), type 2 (MEF-1) and type 3 (Saukett), respectively, were added to each serum dilution, kept for 30 to 60 minutes at room temperature, transferred to HeLa cell cultures, and incubated at 36° C. The end point of each titration was determined by microscopic observations on the fourth and seventh days as revealed by the tube with the last serum dilution completely protecting the cells from the cytopathic effect of the virus.

## Results

Quantitative assay of 111 Brazilian serum samples for antibodies to poliomyelitis viruses by use of the HeLa cell tissue culture technique (13, 14) revealed for each of three socioeconomic groups comparable composite antibody spectrums as determined by occurrence and titer of antibodies (table 1). These data, by presenting the percentage distribution by socioeconomic groups of the occurrence of antibodies to each of the poliomyelitis viruses, types 1, 2, and 3, are brought out more clearly in table 2. Antibodies to all three types were found for 79 percent in group A, 53 percent in group B, and 29

percent in group C. Antibodies to at least one immunotype were demonstrated for all children in group A (average age 8 years), for 97 percent in group B (average age 11 years), and for 96 percent in group C (average age 18 years). The data provided from comparable studies of children (average age 6.5 years) of faculty members at the University of Minnesota (group D) and of University of Minnesota medical students in an age range of from 20 to 30 years (group E) were 15 percent and 16 percent, respectively. Conversely, data for the last two groups gave no evidence of poliomyelitis antibodies, (a) for 30 percent of the children less than 10 years of age, and (b) for 20 percent of the medical students from 20 to 30 years of age. These results from studies of subjects in Minnesota contrast with the results from the Brazilian population in which individuals less than 18 years of age, by socioeconomic group, range from 4 percent to none without antibody.

## Discussion

The present observations establish the fact that poliomyelitis infection has been widespread in Rio de Janeiro and, presumably, in Brazil. Evidence was obtained of infection of most members of three widely different socioeconomic groups by at least 1 of the 3 antigenically recognized types of poliomyelitis virus. The percentage distribution of antibodies ranged from 96 to 100 percent. Indication of infection by all three types of poliomyelitis virus was found to vary from 29 to 79 percent in the three groups. The incidence and distribution of poliomyelitis antibodies in these three groups are similar to other areas of the world (9) with comparable sanitary, climatic, and hygienic conditions. On the other hand, a similar antibody survey for two age groups from Minnesota showed no antibodies in 30 percent of group D (average age 6.5 years) and 21 percent of group E (20 to 30 years of age). Antibodies to the three types of poliomyelitis virus were found to be 15 and 16 percent, respectively.

This serologic study shows that poliomyelitis infections have been widely disseminated in Rio de Janeiro. Presumably, the relative absence of poliomyelitis epidemics in Brazil can be explained in part by exposure to the viruses in

infancy at a time when children are under the protection of maternal antibodies.

## Summary

Clinically recognizable poliomyelitis was accepted in Brazil as an endemic disease of sporadic occurrence until 1953. The disease in 1953 and 1954 assumed epidemic proportions. To provide information helpful to an understanding of the recent epidemic outbreaks in Brazil and of the global epidemiology of poliomyelitis, serologic evidence of the extent of previous poliomyelitis infections in Rio de Janeiro was obtained. Quantitative assay of poliomyelitis neutralizing antibodies in a sample of 111 serum specimens from three different socioeconomic groups (A, B, C) in Brazil was effected by using the HeLa cell tissue culture technique. For comparison, a group of University of Minnesota students (group E) and children of faculty members (group D) were studied. The common presence of antibodies to the three types of poliomyelitis viruses in the lowest socioeconomic section of the Brazilian population (group A) by the eighth year led to the conclusion that, presumably, the relative absence of poliomyelitis epidemics in Brazil can be explained in part by exposure to the viruses in infancy at a time when children are under the protection of maternal antibodies.

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*Analysis of the cancer nursing service in the Nassau County (N. Y.) Department of Health suggests criteria that may be useful to other health departments in appraising a cancer nursing program or as goals to strive for in such a program.*

# Appraising Cancer Nursing Services

—A Study to Establish Criteria—

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CANCER as a disease has long been known to mankind. Only comparatively recently, however, has cancer been generally recognized as a public health problem. In New York State, as in the Nation, cancer now ranks second only to heart disease as a cause of death. In 1953, cancer had an incidence of 281.3 reported cases per 100,000 population and a death rate of 170.4 per 100,000 population in New York State, exclusive of New York City. In view of the size and seriousness of this public health problem, the New York State Department of Health's bureau of cancer control has consistently encouraged local departments of health to develop progressive, integrated programs of cancer control, including public health nursing services.

Nursing has always had a significant contribution to make to the care of patients with

cancer, and public health nursing is peculiarly fitted to play an important role in modern-day cancer control. Public health nursing services can be expected to assume an even greater importance in cancer control programs as public health agencies give increasing attention to all the chronic diseases.

If local health departments are to develop cancer nursing services in an orderly manner, periodic, systematic appraisal of the programs is necessary. For such an appraisal, some criteria by which the programs can be measured to indicate achievements and uncover areas for further development would seem to be required. Therefore, during 1952 and 1953, the New York State Health Department's bureau of cancer control and the Nassau County (N. Y.) Department of Health undertook a study aimed at establishing criteria that could be used in appraising cancer nursing services.

The approach to the problem consisted in an attempt to find out what the essential elements of cancer nursing are as carried out in a specific area, with reference to the following questions:

1. What type of cancer patient is receiving home nursing care?
2. What is the extent of nursing care being given to the patient?
3. Can this information suggest criteria for appraising a cancer nursing program?

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## Study Methods

Nassau County was selected as the area for study for several well-defined reasons.

First, it has an active, well-organized health department.

Second, the health unit has not only an active caseload of nursing visits to cancer patients, but also a sufficient number of patients and visits for valid conclusions to be drawn.

Third, its nursing records are reasonably complete and are readily available for study.

Fourth, in addition to a public health nursing service, other community resources, including hospital, clinic, and ancillary services, are available within or close to the area for assistance in the total care and rehabilitation of cancer patients.

Finally, diagnostic reports are accessible and completely reliable. It was agreed early in the planning period of the study that only those patients for whom a diagnosis of cancer had been made and reported to the health department prior to referral for nursing service would be included. This decision eliminated study of one of the nurse's most valuable contributions to the cancer control program, that is, followup of the "suspected" case until cancer is diagnosed or ruled out. However, it was felt that for the primary purpose of this study, only diagnosed cancer patients should be included, in the interests of accuracy and reliability of the data.

In addition to meeting these general requirements, Nassau County has three specific characteristics which make it an appropriate locale for the study.

First, there is sustained professional and public interest in cancer, as shown by the formation in 1928 of the Nassau County Cancer Committee, and later the appointment of a health educator to its staff, and by the establishment of a tumor clinic in the county hospital in 1932.

Second, the public health nursing service of the Nassau County Health Department reaches a large percentage of reported cancer cases. Since its inception in 1938, the nursing service has been generalized, with each staff nurse giving service to any person in her area referred for health supervision and nursing care in the home. In 1940, it became apparent that the nurses needed more specialized knowledge of

cancer, and a comprehensive inservice education program was started. This program has been continued regularly since that date.

Third, the county health commissioner possesses a firm conviction that cancer nursing is an integral part of and a legitimate function of a comprehensive, generalized public health nursing service, and that as emphasis in public health shifts toward the chronic diseases, the same trend should occur in public health nursing. He and his staff have worked steadily and imaginatively to create and develop good rapport between the county health department, the county cancer committee, and local practicing physicians.

The success of the Nassau County Health Department's approach is reflected in the referrals of cancer patients to the public health nursing service. During the period July 1, 1952, to June 30, 1953, 488 new cancer patients received nursing service out of 1,599 cases in the county reported before death, a percentage of 30.5. The average for upstate New York was 14.1 percent, exclusive of patients receiving care from visiting nurse associations.

The proportion of cancer patients to the total number of patients receiving nursing services is even more interesting. During the same 12 months, the Nassau County Health Department provided nursing services for 21,833 patients. Of these, 626, 2.8 percent, were cancer patients (including both new patients and those readmitted to service). In the rest of New York State, exclusive of New York City, 737 cancer patients received nursing care from the official agencies out of 83,587 patients carried for all nursing services, a percentage of 0.8. The difference between the makeup of the nursing load in Nassau County and that of the rest of the upstate area is statistically significant.

The time period selected for the study was July 1, 1952, through September 30, 1953. One hundred thirty-six new cancer patients consecutively admitted to nursing service during the first 12 months of that period composed the study population. Some difficulty was experienced in accumulating this number of patients for study because frequently patients were referred for nursing service before a definite diagnosis was made. Only those patients for whom a definite diagnosis of cancer had been made

# Worksheet Used for Recording Data

Village or city:		County:		Name:		Diagnosis:	
Age:		Sex:		Date referred to nurs. serv.:		Date first visit by nurse:	
						Total visits:	
Referred by: Hospital <input type="checkbox"/> Private physician <input type="checkbox"/> Other agency <input type="checkbox"/> Family or friend <input type="checkbox"/> Self <input type="checkbox"/>						Referred for:	
Classification:		Stage:		Status:		Disposition of case:	
Surgical <input type="checkbox"/>		Early <input type="checkbox"/>		Ambulatory <input type="checkbox"/>		Died <input type="checkbox"/>	
Nonsurgical <input type="checkbox"/>		Late <input type="checkbox"/>		Part-time ambulatory <input type="checkbox"/>		Discharged to hospital <input type="checkbox"/>	
Radiation <input type="checkbox"/>				Bedridden <input type="checkbox"/>		family <input type="checkbox"/>	
						other <input type="checkbox"/>	
						Active <input type="checkbox"/>	
NURSING SERVICES							
Physical Care		Given by Nurse	Dem. to Pt.	Dem. to Fam.	Super-vised	Supportive Care	
General care (full or partial)						Motivate to medical care	
Dressings						General health instruction (nutrition, etc.)	
Enema						Referral to other agencies	
Irrigations						Followup nursing supervision	
Diet and special feedings						Emotional support	
Injections						Assistance with special problems	
Rehabilitation procedures						Other (specify)	
Sitz bath							
Surgical assistance to doctor							
Tracheotomy, laryngectomy care							
Tube feeding (nasal, gastric)							
Vaginal douche							
Other (specify)							

and reported to the health department prior to referral for nursing service were included in the study group.

The nursing service for each patient was studied for 3 months, unless the patient died or was discharged earlier. A worksheet, shown above, was devised for recording the desired data and was completed for each patient in the study. The data were obtained almost exclusively from the nurses' records; interviews with nurses for the collection or supplementation of data were kept to a minimum.

## Sex Distribution and Leading Sites

The sex distribution of the patients in the study favored females. Eighty-one, 59.5 percent, were females, and 55, 40.5 percent, were males. The distribution of all reported cancer cases in Nassau County in 1953 was more nearly equal; 48.3 percent of the cases were in males, and 51.7 percent were in females. It may be that more women than men received nursing service because the site of the cancer and the special needs of patients having cancer of cer-

**Table 1. Distribution of nursing care patients according to site of cancer**

Site	Males		Females		Total	
	Number	Percent	Number	Percent	Number	Percent
Intestine.....	11	20.0	17	20.9	28	20.6
Breast.....	0	0	20	24.7	20	14.7
Rectum-anus.....	7	12.7	8	9.9	15	11.0
Respiratory system.....	11	20.0	0	0	11	8.1
Skin.....	7	12.7	0	0	7	5.1
Cervix.....	0	0	6	7.4	6	4.4
Stomach.....	0	0	5	6.2	5	3.7
Prostate.....	5	9.1	0	0	5	3.7
All others.....	14	25.5	25	30.9	39	28.7
Total.....	55	100.0	81	100.0	136	100.0

tain sites determine which patients are referred for nursing care.

Cancer of every system and of most anatomical sites was represented in the study group. As shown in table 1, 5 sites accounted for about 60 percent of the nursing caseload: intestine, breast, rectum-anus, respiratory system, and skin. In Nassau County in 1953, the respiratory system and the intestine were the second and third most frequent sites of cancer among males, exceeded only by the skin; and the breast was the leading site of cancer among females. In the study group, patients with cancer of the intestine and those with respiratory cancer were the most numerous among the men, and patients with breast cancer were the most numerous among the women. These data indicate that the distribution of nursing care patients by site of the cancer tends to follow the distribution of all reported cancer patients.

### Physical Care Services

Of 1,290 physical care services given, the women received 935 (72.4 percent), nearly 3 times as many services as the men. As previously stated, there were only about 1½ times as many women as men in the study group. One possible explanation for the preponderance of physical care services being given to the women is that the site of the cancer dictates the amount and kind of physical nursing care necessary. The data in table 2 tend to support this view.

Cancer of the respiratory system, one of the leading sites among the men, received only 3.8

physical care services per patient. This may be because of the limits to home nursing care imposed by cancer of this site. In general, the course of lung cancer, as compared with cancer of other sites, is of relatively short duration. Much of the treatment is given in the hospital, and upon discharge the patient may have little need of physical nursing care services.

On the other hand, cancer of the breast, the leading site among the women, may require a number of physical care services, such as dressings and rehabilitation procedures, to be given

**Table 2. Number of physical care services according to site of cancer**

Site, by sex	Number of patients	Number of services	Number of services per patient
<i>Males</i>			
Respiratory system.....	11	42	3.8
Intestine.....	11	147	13.4
Rectum-anus.....	7	28	4.0
Skin.....	7	29	4.1
Prostate.....	5	60	12.0
All others.....	14	49	3.6
Total.....	55	355	6.4
<i>Females</i>			
Breast.....	20	252	12.6
Intestine.....	17	237	13.9
Rectum-anus.....	8	73	9.1
Cervix.....	6	31	5.1
Stomach.....	5	52	10.4
All others.....	25	290	11.6
Total.....	81	935	11.5

**Table 3. Number and percentage of physical care services**

Service	Services for males		Services for females		Total services	
	Number	Percent	Number	Percent	Number	Percent
General care.....	90	25.3	197	21.1	287	22.2
Dressings.....	88	24.8	190	20.3	278	21.6
Irrigations.....	48	13.6	220	23.6	268	20.8
Injections.....	60	16.9	187	20.0	247	19.1
Enemas.....	46	12.9	76	8.1	122	9.5
All others.....	23	6.5	65	6.9	88	6.8
Total.....	355	100.0	935	100.0	1,290	100.0

in the home. Breast cancer received 12.6 physical care services per patient, next to the highest number of services given to the women.

Considering all women patients and all men patients, however, we find that the women required an average of 11.5 physical care services as compared with 6.4 for the men. Possibly the reason for this difference lies in factors not revealed by the data collected for this study.

Table 3 shows that 5 types of service accounted for 93 percent of all physical care services given: general care, dressings, irrigations, injections, and enemas. For the men, general care was given most often; for the women, irrigations were most common. It should be noted here that one elderly woman in the group received an unusually large number of irrigations given by the nurse because it was not possible for a member of the family to assume complete responsibility. In this relatively small group studied over such a short period of time as 3 months, it is possible that 1 or 2 patients may influence the statistical picture to a disproportionate degree.

#### Supportive Care Services

It is difficult to make a division between physical care services and supportive care services in evaluating total nursing services. For the purpose of collecting and analyzing the data, an attempt was made in this study to make such a division, but for interpreting the data it is necessary to bear in mind certain intangible factors that operate significantly in good nursing care. For example, it is hard to imagine a good nursing visit made for the purpose of

**Table 4. Distribution of supportive care services according to site of cancer**

Site, by sex	Number of patients	Number of services	Number of services per patient
<i>Males</i>			
Respiratory system.....	11	19	1.7
Intestine.....	11	37	3.4
Rectum-anus.....	7	16	2.3
Skin.....	7	14	2.0
Prostate.....	5	4	.8
All others.....	14	44	3.1
Total.....	55	134	2.4
<i>Females</i>			
Breast.....	20	32	1.6
Intestine.....	17	51	3.0
Rectum-anus.....	8	22	2.8
Cervix.....	6	14	2.3
Stomach.....	5	12	2.4
All others.....	25	92	3.6
Total.....	81	223	2.7

giving a bath or doing a dressing that does not also include some awareness by the nurse of the patient as a person, with his emotional needs and responses peculiar to himself at that time.

Of 357 supportive care services given, women received 223 (62.5 percent), and men, 134 (37.5 percent). This follows fairly closely the sex distribution of the study group.

Table 4 shows that there was little difference between the sexes when the distribution of supportive care services by site was studied. The men averaged 2.4 supportive care services; the women, 2.7. As with physical care services, the number of supportive care services per pa-

**Table 5. Number and percentage of supportive care services**

Service	Services for males		Services for females		Total services	
	Number	Percent	Number	Percent	Number	Percent
Emotional support.....	49	38.5	81	36.3	130	36.4
General health instruction.....	39	29.1	55	24.7	94	26.3
Assistance with special problems.....	21	15.7	39	17.5	60	16.9
All others <sup>1</sup> .....	25	18.7	48	21.5	73	20.4
Total.....	134	100.0	223	100.0	357	100.0

<sup>1</sup> Includes motivation to medical care, referral to other agencies, followup nursing supervision, and other services.

tient tended to be more affected by site of the cancer than by sex of the patient. Cancer of the intestine, for example, required the most supportive care, regardless of the sex of the patient.

According to tables 2 and 4, approximately 3½ times as much nursing service was devoted to the physical care of the patient as to his supportive care. As previously noted, however, it is next to impossible to divorce physical care from supportive care. It is very probable, therefore, that more supportive care was given than would be indicated by the nurses' records. Good nursing care includes recognizing and attempting to meet the emotional needs of the patient as well as the physical needs. But so much of supportive care is incidental, if not

perhaps unconscious, that nurses usually do not record it. This is unfortunate since the public health nurse is especially trained to assist in those services listed as supportive. Unless it is clearly understood and accepted that this service is an important and integral part of her function, many persons may be led to assume that physical care services alone constitute an adequate nursing visit and that the visit can thus be made by someone with less formal training. For the maximum service to the patient, complete nursing care must include both physical and supportive care to the degree indicated by the needs of the patient.

The most interesting finding revealed by table 5 is that three general types of supportive service—emotional support, general health instruction, and assistance with special problems—comprised approximately 80 percent of all supportive services. Furthermore, with minor deviations, these three types were about equally distributed among men and women.

**Table 6. Number and percentage of nursing care services according to specified classifications**

Service	Services for males		Services for females	
	Number	Percent	Number	Percent
<i>Physical care</i>				
Given by nurse.....	286	80.5	820	87.7
Demonstrated to patient or family.....	39	11.0	67	7.2
Supervised.....	30	8.5	48	5.1
Total.....	355	100.0	935	100.0
<i>Supportive care</i>				
Directed to patient.....	76	56.7	156	69.9
Directed to family.....	58	43.3	67	30.1
Total.....	134	100.0	223	100.0

### Extent of Nursing Care

One measure of the extent of nursing care was obtained by tabulating physical care services according to three classifications as shown in table 6: services given by the nurse, which included care given to the patient in which demonstration or teaching was incidental rather than a primary objective; services demonstrated to the patient or family, which included care given by the nurse to show how to do a procedure, the eventual goal being to have the patient or his family assume this responsibility; and services supervised, which included the nurse's visit to observe a procedure, answer



questions, and evaluate the situation after the patient or family had assumed responsibility for care.

A large percentage of the physical care services were actually administered by the nurse, and only a small percentage were demonstrated to the patient or family. Although this was true for both men and women, a higher percentage of services were demonstrated for the men than for the women. One explanation for this difference might be that a wife is more likely to assume nursing duties when her husband is ill than is a husband when his wife is ill. It was also found that a large proportion of the study group were in the late stage of the disease. Nearly a third of the patients died within 3 months after admission to nursing service. It can probably be assumed that a great many of the patients were already too ill and the family already too exhausted physically and emotionally for anyone but the professional nurse to undertake the patient's care.

"Services supervised" should be one indication of the patient's or family's degree of success in achieving self-sufficiency. The nurse was satisfied that self-sufficiency had been attained in 8.5 percent of the physical care services for men and in 5.1 percent for women.

Table 6 also shows a tabulation of supportive care services according to services directed to the patient and services directed to the family. More of the services fell into the first category than the second for both men and women. This finding may be a demonstration of a desirable principle of nursing care, that is, help the pa-

tient to help himself first and thus aid him in establishing independence and security.

The women patients received a higher percentage of supportive care services directed to themselves (69.9 percent) than did the men (56.7 percent). It may be that in many instances other members of the family were at places of employment outside the home at the time of the nurse's visit. However, it was the exceptional patient who lived alone.

### Age, Referrals, and Disposition

The men in the study group tended to be older than the women, with 92.8 percent of the men over 45 years of age compared with 77.8 percent of the women. However, the number of visits per patient was higher in each age group for women than for men. The greatest number of visits per patient occurred in the 25-34 age group for women, but there were very few patients in this group. The data on age and number of visits are shown in table 7.

As shown in table 8, 88 patients (65 percent) were visited by the public health nurse on the day of referral, and 104 (76.4 percent), within 2 days. Seventeen patients (12.5 percent) were not visited until the ninth day or later. A local situation in the county may have some bearing on this last finding. Fourteen of these seventeen patients were referred by the local hospital, which has a tumor clinic. All patients attending the clinic are referred to the health department nursing service for followup or because of missed clinic appointments. The

Table 7. Age distribution of patients and number of nursing visits

Age, in years	Males				Females			
	Number of patients	Percent	Number of visits	Visits per patient	Number of patients	Percent	Number of visits	Visits per patient
Under 24.....	2	3.6	5	2.5	1	1.2	13	13.0
25-34.....	0	0	0	0	3	3.7	43	14.3
35-44.....	2	3.6	9	4.5	14	17.3	168	12.0
45-54.....	6	10.9	24	4.0	12	14.9	89	7.4
55-64.....	23	41.9	216	9.4	21	25.9	266	12.7
65-74.....	11	20.0	89	8.1	15	18.5	183	12.2
75 and over.....	11	20.0	50	4.6	15	18.5	163	10.9
Total.....	55	100.0	393	7.1	81	100.0	925	11.4

**Table 8. Time interval between referral and first nursing visit according to source of referral**

Source of referral	Time interval				Total	
	Same day	2 days	3-8 days	9 or more days	Number	Percent
Private physician.....	51	10	8	3	72	52.9
Hospital.....	28	2	6	14	50	36.8
Other.....	9	4	1	0	14	10.3
Total.....	88	16	15	17	136	100.0

patient's clinic return date may be a considerable time after the date referral to the nursing service is made, and these referrals receive no priority in the public health nurse's schedule. Therefore, the nurse may delay her first visit until near the time of the patient's clinic appointment. If immediate nursing were needed, the referral notice would so indicate. With the exception of these 17 patients, the time interval between referral and first nursing visit was fairly consistent for the various sources of referral.

Table 8 also gives the number and percentage of patients referred by each source. Of the 72 patients (nearly 53 percent) referred by private physicians, 46 were women and 26 were men, a male to female ratio slightly more in favor of women than the sex distribution of the study group. Of the 50 patients (36 percent) referred by the hospital, women numbered 26, and men, 24. Other sources, which accounted for only 14 of the patients, included self or family.

A striking fact revealed in table 9 is that, of the 135 patients for whom the stage of disease was known, 121 (89.7 percent) were in the late stage when diagnosed. Only 14 (10.3 percent) were in the early stage. In 1953, Nassau County reported 1,900 new cancer cases. The physician designated the stage of disease at time of diagnosis in 1,603 of these. Of this group, 334 (20.8 percent) were cases in the early stage of disease.

The fact that a preponderance of the cases referred for nursing service were late cases may have significant implications for nursing. If we believe nursing as well as medicine can make its maximum contribution to the welfare of the patient during the early stage of a disease,

then obviously the opportunity diminishes as the disease progresses. But physicians may feel that the patient should be maintained without nursing supervision in the home until the late or even terminal stage has been reached. Table 9 shows that 42 patients (30.9 percent) died within 3 months after referral (the period of study of each patient), a finding that appears to lend support to this theory. Possibly physicians do not wish some patients to know or even suspect the diagnosis of cancer and feel that referral for nursing care early in the course of the disease might arouse the patient's anxieties. Or perhaps patients are referred for health department nursing care only after the family has exhausted its own resources, both physical and emotional.

Table 9 also reveals that 37 patients, 27.2 percent, were discharged to themselves or their families. It may be inferred that these patients had achieved enough self-sufficiency to be responsible for their own followup, subject,

**Table 9. Disposition of patients by stage of disease at time of diagnosis**

Disposition	Stage of disease <sup>1</sup>		Total	
	Early	Late	Number	Percent
Died.....	1	41	42	30.9
Discharged to hospital...	3	11	14	10.3
Discharged to self.....	4	16	20	14.6
Discharged to family.....	2	15	17	12.5
Discharged to private duty nursing.....	0	2	2	1.5
Active.....	4	36	41	30.2
Total.....	14	121	136	100.0

<sup>1</sup> Stage of disease unknown for one patient.

of course, to regular medical supervision. If those patients who died are excluded from the calculations, then the percentage of patients who achieved self-sufficiency is 39.4. This finding is especially gratifying since 89.7 percent of the patients were already in an advanced stage of the disease when referred for nursing service. Forty-one patients, 30.2 percent, were still receiving visits at the end of the 3-month period of study.

### Criteria and Goals

From this study and from the Nassau County Health Department's experience emerge certain findings which we believe may be useful to health officers as criteria for evaluating a cancer nursing service or as goals to strive for in such a program, even though the study group was small and the study period short. These findings have been divided into two groups: group A, those that may be reproducible elsewhere, that is, those that should not be influenced by local conditions; and group B, those that may be peculiar to this county because of local circumstances but that we feel indicate a good quality of service and are therefore desirable in a well-integrated cancer nursing program.

#### GROUP A

1. At least 30 percent of the reported cancer cases, exclusive of those reported at time of death, are receiving public health nursing service.

2. At least 2 percent of the total patients carried for public health nursing are cancer patients.

3. The distribution of cancer patients referred for nursing service, both male and female, corresponds to the distribution of the predominating cancer sites of all patients in the locality.

4. The site of the cancer, rather than the sex of the patient, largely determines the number of physical care services and supportive care services given.

5. Physical care services constitute an important part of the cancer nursing visit. They con-

sist predominantly of general care, dressings, and irrigations.

6. Supportive care services also constitute an important part of the cancer nursing visit. They consist predominantly of emotional support and general health instruction.

7. One measure of the effectiveness of the nursing service is the proportion of patients discharged either to themselves or their family.

#### GROUP B

1. In a health department where there is effective cancer reporting and an established nursing service and where there is a genuine desire to provide nursing services for chronic disease patients, 30.5 percent of the reported cancer cases, exclusive of those reported at time of death, are receiving nursing care. This cancer caseload constitutes 2.8 percent of all cases carried for nursing service.

2. The public health nurse visits 76 percent of the referred cancer cases within the first 2 days.

3. Referrals for nursing service present the following pattern: 53 percent by private physician; 37 percent by hospitals; 10 percent by self, family, or other community agency.

4. Twenty-seven percent of the patients are discharged either to themselves or their family within 3 months after the nurse's initial visit. When those patients who die are excluded from this calculation, 39.4 percent of the cases achieve this measure of self-sufficiency.

5. The average number of visits per cancer patient ranges between 7 and 12, depending on age and sex of the patient.

It is not realistic, of course, to expect other health departments to arrive at exactly the same results in appraising their cancer nursing programs as were found in Nassau County. But the health officer may find these criteria and goals helpful in reviewing his cancer nursing program. In the course of such an appraisal, he should honestly ask himself what factors are governing his cancer nursing service. Is it a token service to satisfy community pressures? Is it dependent upon the interest of only a few nurses? Or is it a planned program within the framework of his public health objectives?

# idea

## *Modified Oscilloscope*

Monitoring a patient's blood pressure and electrocardiogram in difficult heart surgery has vital significance to the surgeon and anesthesiologist. The usual monitoring device is a cathode-ray oscilloscope. These oscilloscopes are expensive, often bulky, and because of an excessive number of controls, rather difficult to operate.

These disadvantages have recently been reduced by a modification of this instrument by F. W. Noble, M.E.E., B. R. Boone, M.D., N. McC. Garrahan, and R. E. Gorman of the National Heart Institute, National Institutes of Health, Public Health Service.

The National Heart Institute announced the successful application to an electrocardiograph machine of a version of an electronic switch that makes possible the adaptation of all existing single-beam oscilloscopes to perform like more complex double-beam instruments.

Though the cheaper and more frequently available single-beam oscilloscope has only one light source, with the addition of the electronic switch, it traces two curves on the screen. This is achieved by a rapid redirection and alternation of the light source between the curve above and the curve below. The switching process continues indefinitely, leaving behind two separate and distinct tracings.

A detailed technical description of the switch appears in the September 1955 issue of *The Journal of Laboratory and Clinical Medicine*.



# Malaria Control in Turkey

By FREDERICK W. KRATZ, M.D., and  
C. BRADLEY BRIDGES, M.P.H.

**T**URKEY—astride the strategic Bosphorus and Dardanelles—has long been a land of mystery and enchantment to the average American. Its civilization is what one would expect of a country which lies partly in Europe and partly in Asia. Though turned toward the West in thought and ideas, it is a nation blending the customs of Eastern and Western cultures in spite of the prediction that “ne’er the twain shall meet.”

Asia Minor, or Asiatic Turkey, is about 97 percent of the total land area of the country (287,246 square miles). Thrace, the extension of the European Balkan Peninsula, occupies only about 3 percent. Both portions of the once great Ottoman Empire are historically malarious. The Sultan’s soldiers, returning from World War I to rally around Kemal Ataturk, not only maintained malaria in epidemic proportions but brought with them strains of new plasmodia, which swept through the homeland with renewed energy (1, 2).

In the years since the founding of the Repub-

lic of Turkey, in 1923, great emphasis has been given to improvement of the general health. Malaria incidence has been in general decline since 1946 as a result of the persistent control operations under the Directorate of Malaria Control (3). These efforts had long been hampered by general shortages of funds, equipment, and insecticides.

In May 1950 the United States Economic Cooperation Administration Health Mission to Greece sent representatives to Turkey in order to establish the basic agreements which led eventually to a program of material and technical assistance in malaria control.

In November of the same year a working agreement was set up between the Economic Cooperation Administration and the Turkish Ministry of Health and Social Assistance. The ECA public health group, composed of a physician, sanitary engineer, and malariologist, arrived in Ankara in March 1951 to work as consultants in the malaria control operations of the Turkish Ministry of Health until the close of the assistance program, June 30, 1953.

Material assistance furnished under these agreements included principally insecticides, sprayers, and automotive equipment.

## Progress in International Cooperation

<sup>1</sup> Turkey has four separate topographical regions whose climates are completely different. Each region presents its problems in the control of malaria.

Asiatic Turkey is almost completely ringed with mountains which fall away rapidly toward

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*Dr. Kratz and Mr. Bridges went to Turkey in 1951 as public health consultants. Dr. Kratz, who is medical officer in charge, Pacific Northwest Foreign Quarantine District, Public Health Service, Seattle, was chief of the public health group during the malaria control program. Mr. Bridges was the malariologist with the group and is now training officer at the Communicable Disease Center, Public Health Service, Atlanta. The third member of the group was George W. Hintgen, malaria control engineer.*

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## *Modified Oscilloscope*

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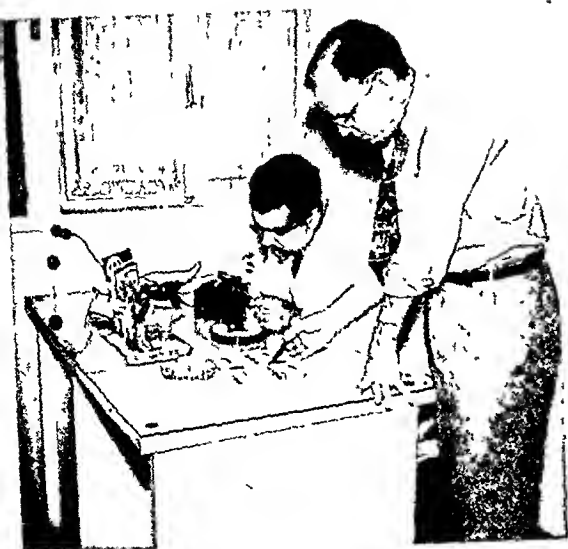
These disadvantages have recently been reduced by a modification of this instrument by F. W. Noble, M.E.E., B. R. Boone, M.D., N. McC. Garrahan, and R. E. Gorman of the National Heart Institute, National Institutes of Health, Public Health Service.

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Studying the biology of vectors.

years activity patterns have evolved which substantially increase the opportunity of malaria transmission in the presence of capable vectors.

The sparse summer rainfall in most of Turkey necessitates the extensive use of irrigation during the growing season. The improper management of irrigation water in rice culture and in other crops leads to a malaria problem here as well as elsewhere in the world.

The danger from rice irrigation is somewhat reduced by a law which requires that all rice fields less than 3 kilometers from a village be dried 48 hours every 10 days, but there is no such control on water used in irrigation of other crops to lessen mosquito breeding (4).

The lack of fences in Turkey has led to the custom of crop watching. During fruiting time a watch is maintained from an elevated platform day and night against marauding men and livestock. The guard is often joined by his entire family. With a most convenient blood meal near at hand, the vectors need not travel to the villages or herds to fill their needs. A similar blood-feeding situation results when the people sleep on rooftops to escape the inside heat on hot summer nights.

As in the United States, laborers migrate from one area to another during the harvest season. They live in tents or other temporary dwellings impossible to cover in a control program, then return when the harvest season is over to their Anatolian homes, carrying infec-

tions with them. Migrations of a lesser magnitude are those of a few nomadic tribes who follow grazing as the seasons open or close.

### The Malaria Control Organization

Owing to the prevalence of malaria in Turkey in the period following World War I and the early days of the Republic (5), malaria control activities were begun on a national level by the Ministry of Health and Social Assistance in 1925.

Studies of the mosquito fauna in those years established the presence of such formidable vectors as *Anopheles superpictus* as well as *Anopheles sacharovi*. Although the existence of three subspecies of *Anopheles maculipennis* was also established, these subspecies (*typicus*, *messeae*, and *melanoon*) were fortunately not the efficient vectors of southern Europe (6). Seven other *Anopheles* were established, namely, *algeriensis*, *claviger*, *marteri*, *multicolor*, *plumbeus*, *sergentii*, and *hyrcanus* (7).

The malaria workers of the Directorate of Hygiene enjoyed reasonable progress until the World War II period. Economic crises and shortages brought widespread epidemics to the Mediterranean and Aegean areas. In 1946 malaria control was set up as a separate division for the administration of the program. The National Assembly gave legal authority to the new agency to control malaria by almost any effective means (4).

Operating at a high federal level, the directorate, under the Ministry of Health and Social Assistance, carried out its program through



Examining patient for spleen enlargement.

the sea, forming a strip of flat coastal plain of varying width. This plain is adjacent to the Black, Marmara, Aegean, and Mediterranean Seas. European Turkey is also a coastal plain since it is the corresponding area between the Balkans and the Black, Marmara, and Aegean shores.

Malaria has been firmly entrenched in the coastal plain for centuries. This is particularly true of the Aegean and Mediterranean areas where Greek and Roman cities suffered the ravages of the disease. Its ample rainfall and mild-to-tropical climate make it still the area requiring most attention.

The watershed from the coastal side of the mountains, the flood plains of great rivers entering the sea, and the outcropping of the water table furnish ample mosquito-breeding habitats in the form of pools, marshes, and seepage areas. In the south the mosquito-breeding season is continuous, with only minor recessions in winter. Progressing northward, more definite seasonal lines may be drawn.

More than half the land area of Turkey is in Anatolia, a high, saucer-shaped plateau, much like the arid plateaus just east of the Rocky Mountains in the United States. Anatolia, the Turkish homeland, may be called the heart as well as the breadbasket of the country.

The winters are cold and the summers are hot with cool, breezy nights. Continuous warm weather does not begin until very late spring, confining mosquito breeding generally to the months from June to October. Dry summers limit malaria transmission to areas adjacent to water courses or to the numerous brackish marshes and lakes. Villages are, of necessity, located near water sources, thereby making malaria control services obligatory in most areas of Anatolia. The necessity of irrigation is general. However, the annual grain crop is largely dependent on the heavy snow and rain of winter.

Since large parts of Anatolia are not drained by the big river systems, runoff water often accumulates in large marshes and lakes. This makes wasteland of vast areas. Spring floods expand their size enormously, and summer drought greatly reduces them, leaving crusty layers of mineral salts after the water evaporates.

The rugged mountain country of eastern Anatolia has narrow, fertile valleys where good crops of grain and fruit are grown. The severe winters, short summers, and restricted breeding areas place natural limitations on malaria. Southeast Anatolia is a foothill region where the mountains decline to the rolling hills of Syria, Iraq, and Iran. Primitive living conditions plus long, hot, dry summers, which are relieved by heavy autumn, winter, and spring rains, make malaria control measures necessary. Some of the highest spleen rates are reported from southeast Anatolia.

Prior to the arrival of Osmanli, or Ottoman Turks, in the 11th century A. D., the residual population of Asia Minor was subjected to the sweeping tides of conquests from both the East and the West. Almost any racial characteristic can be found from the Mongoloid to the Nordic, but the people are predominantly of the Mediterranean type. The highest population densities are found in the approaches to Europe, that is, the Marmara and Black Sea coastal plains. Not only are many of the larger cities located there, but the towns and villages are larger and more numerous.

Turkey is predominantly a rural nation. Only 7 percent of its population lives in the urban centers above 50,000 in population. The term "rural" as applicable to the United States cannot be used here. Isolated homesteads are nonexistent. The entire population lives in communal groups from small villages to larger towns and cities. In the United States we speak of malaria as being a rural problem, but in Turkey it is a village problem.

Malaria has no doubt played a leading role in shifting greater densities to the Marmara and Black Sea coasts. Along the Aegean there have been Roman and Greek cities of fabulous size and grandeur—Troy, Ephesus, Perga, Aspendus, Soli, and Korykos. They are ruins today, mute evidence of the combined influence of malaria, decadence, and earthquakes. Even in recent years, Antalya, the modern counterpart of Perga, has reported malaria rates as high as 85 percent (1).

A large majority of the people are engaged in various agricultural pursuits, which include herding livestock as well as intensive cultivation of small vegetable farms. Through the



**Table 2. Percent of total hospital admissions and deaths among malaria admissions, 1946-51**

Year	Percent of admissions	Percent of deaths
1946-----	5.0	2.6
1947-----	3.6	2.4
1948-----	3.2	2.0
1949-----	2.7	1.6
1950-----	1.6	1.4
1951-----	1.4	1.1

**Table 3. Progress in reduction of malaria incidence, 1946-52**

Year	Spleen index	Percent reduction
1946-----	25.9	-----
1947-----	19.8	24
1948-----	14.7	26
1949-----	10.5	28
1950-----	7.1	30
1951-----	4.3	54
1952-----	2.1	40

were confined to persons having highly indicative clinical symptoms. Presently these surveys cover:

Spleen examinations for all inhabitants of village included under malaria control.

Blood smears on all children up to 10 years of age.

Blood smears on all persons having positive spleens.

Owing to the fact that the results of blood and spleen surveys through the years cannot be correlated, only the results of the spleen examinations have been tabulated. Blood examinations were done for the past 5 years, and spleen surveys were carried on for 27 years. Tables 1-3 cover only the results of village or rural examinations. There are clinics in the cities and large towns where people seeking medical treatment are examined. Should these reports be included, the population protected would be more than 9 million, or nearly half the total population.

Since some 80 percent of the malaria reported in Turkey is caused by *Plasmodium vivax* (1), Turkish physicians are accustomed to have between 20 percent and 30 percent of their treated

patients relapse under the present system of therapy. Any new drug on the market that can reduce this relapse rate is looked upon with great anticipation. The efficacy of primaquin with chloroquin has been covered in numerous training courses and conferences. The adoption of the use of more effective antimalarials is further hindered by the fact that a large stock of atabrine was brought from Egypt in 1951.

### Vector Control

The success of any control measure in Turkey is dependent on how well the measure ties in with the habits of *A. sacharovi* and *A. superpictus*. Although there are anopheline vectors (*A. claviger*, *A. bifurcatus*, and *A. sergentii*) present which are of importance in other areas, in Turkey they are of secondary importance. Village houses are used to shelter animals as well as humans. Readily available animals for blood meals doubtless form protective barriers around man which are penetrated mainly by those primary vectors (*A. sacharovi* and *A. superpictus*) which show a definite preference for human blood.

Several of these anophelines have characteristics so similar that the species are separated only with difficulty. Identification involved time and equipment out of proportion to our systems. A primary accomplishment of the period of United States cooperation was the development of a simple pictorial key by which species could be separated in the field with a hand lens.

A program of routinely collecting larvae and adult mosquitoes was introduced also. Morbidity records have existed for some time. By correlating records of morbidity and vector indexes, justification for control operations can be established.

Since limited amounts of DDT were available for malaria control in the past, considerable emphasis was placed on oil larviciding of breeding areas. DDT first became available to Turkey in 1946, beginning with 2 tons, and gradually increasing to almost 100 tons in 1949. As more DDT became available from United States aid (750 tons a year for the next 3 years), larvicides were deemphasized, and DDT residual spraying assumed a more important role.

provincial and district medical directors at the local area. This same type of organization is still in existence. With the advent of United States cooperation, new areas were included in the control program.

The sanitarian is the key man at the local level. Though subprofessional by training and experience, he is responsible for substandard diagnostic screening of malaria cases, the dispensing of antimalarial drugs, entomologic inspections, the supervision of residual spraying and larviciding, and the gathering of statistical data. He is directly responsible to a medical officer, who either substantiates or disproves the diagnoses made by the sanitarian. A sanitarian is assigned to 10 to 15 villages and is required to visit each village twice a month on schedule.

The Directorate of Malaria Control is administratively in control of the Malaria Institute in Adana, which is its training arm. Inservice training is generally given at three different levels.

1. Physicians are given a 6 weeks' course in all phases of malaria work from diagnosis to insecticide dispersal. On returning home, they give similar courses for their associates in the district and throughout the province.

2. Laboratory technicians are given training for a similar period in the preparation and identification of blood parasites as well as taxonomy of mosquitoes and other insects.

3. Sanitarians' inservice refresher courses usually are of 4 weeks' duration. Designed to meet the needs of sanitarians in the field, the subjects are approached from a practical point of view. Although coverage is given to all phases of malaria control activities, particular emphasis is given to insecticides, their use, and application. A formal 3-year course in all phases of sanitation activities prior to service in the various directorates is continually improving the quality of sanitarians. The supply of these graduate sanitarians does not fulfill the needs of the Ministry of Health.

At local and national levels inservice training of the older and nongraduate sanitarians is a major endeavor aimed at raising their efficiency in the broad field they cover in addition to the malaria control program.

During the period of United States assistance in malaria control, these courses were a cooperative enterprise. The Public Health Service officers were instructors at the Malaria Institute. Such joint undertakings served to improve working relations and to promote a deeper understanding of existing problems. The courses, more than anything else, served to disseminate information quickly to the operational level.

## Malaria Control Operations

Examination and treatment of suspected cases of malaria have been mainstays of the operational program. During the normal season, a sanitarian on his routine visits to each village makes the diagnoses and issues anti-malarials, usually atabrine. Guided by an operational manual, he maintains records dealing with every occupant of each house in the village. Such pertinent data as splenic enlargement, results of blood examinations, and age and sex of the occupants are recorded. The examinations of blood for malaria parasites are made by the local physicians and technicians assigned to the malaria control program.

Since 1946, a malaria survey has been made each fall by the district medical director in each village of the 34 control areas. Great emphasis has been placed on enlarged spleens as an index to the prevalence of malaria. Since 1951, more emphasis has been placed on blood examinations. Before this period, blood examinations

**Table 1. Data on Turkish spleen examinations, 1946-54**

Year	Population in control areas	Percent examined	Percent with positive spleens
1946-----	6, 032, 573	78. 1	25. 9
1947-----	6, 036, 073	73. 9	19. 8
1948-----	6, 403, 475	70. 3	14. 7
1949-----	5, 398, 767	80. 1	10. 5
1950-----	5, 307, 420	85. 6	7. 1
1951-----	5, 717, 394	90. 9	4. 3
1952-----	5, 983, 502	75. 5	2. 1
1953-----	(1)	(1)	2 1. 4
1954-----	(1)	(1)	2 1. 1

<sup>1</sup> Figures not available. <sup>2</sup> Percentages of positive spleens taken from reference 8.

annual application is performed during a 6-week period in the spring. However, in the more tropical regions where there is no marked break in the mosquito-breeding season, two or more additional applications are required.

For the most part, the buildings in rural Turkey are constructed of mud and similar materials. More than 80 percent of the buildings have these porous and absorptive surfaces for which emulsions and solutions of DDT are not suited. Therefore, water-wettable suspensions of DDT have replaced these other formulations. Solutions and emulsions are used for spraying less absorptive surfaces for areas where the white residue of water-wettable DDT would be objectionable. The flat fan spray nozzles with delivery rates of 0.2 and 0.4 gallon a minute are standard equipment in all spray operations. The stainless steel tip nozzle, which is designed for delivery at 0.4 gallon a minute, has given better service with DDT suspensions than the brass tip nozzle because erosion does not enlarge the aperture so quickly.

DDT has been used in limited amounts since 1946 with no reported ill effects to humans since adequate precautions have been taken to protect food, utensils, and sprayer operators. In some provinces in 1952, DDT was believed to have contributed to a high mortality in silkworms. Silkworm culture is carried on inside homes, and spraying in the homes leads to obvious difficulties. Special instructions excluding the homes from spraying operations have thus far prevented a recurrence of damage claims.

General insect control to a high degree has

been achieved during the past three seasons with chemicals. The spray program has been popular, more often for comfort and convenience than for malaria control. People outside the 12,600 villages under control have attempted various means to have their villages included in the program.



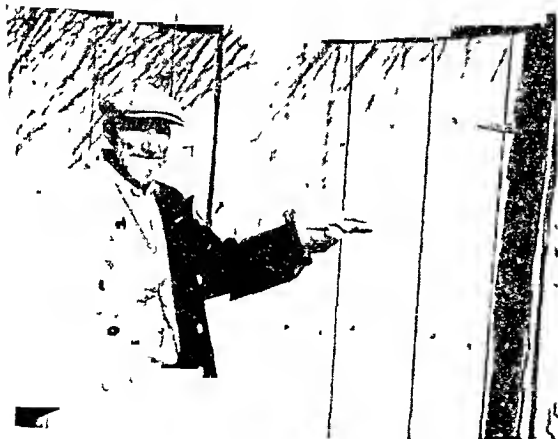
Water-wettable DDT is mixed for spraying in a Kurd village in eastern Turkey. Note goat-skin water bags.

In Turkey, as in all other parts of the world, houseflies have developed some tolerance to DDT. Though many claims of resistance can be attributed to localized operational inadequacies, the main fault lies in the fact that housefly control is unobtainable after a few years of DDT spraying and related chemicals, when such measures are not part of an integrated sanitation program which includes proper disposal of garbage and human wastes.

The reports of resistance in *A. sacharovi* from Greece caused some concern, but where efficient spray operations prevailed there were no credible parallels observed in Turkey. Most cases investigated revealed that DDT residues had been masked by smoke, greases, and the like, or that hard-to-reach surfaces had not been sprayed.

The existence of true resistance or modified behavior patterns due to irritant repellancy of DDT (9) was not established by biological tests during the period of American aid in malaria control.

Malaria in Turkey has been reduced to a fraction of its former incidence. As in many parts of the world, the extensive and intelligent



Indicating mark of DDT application.



Mixing spray materials.

Where larviciding is indicated, it is accomplished with the use of a DDT solution made with fuel oil to which a spreading agent was added. Applications approximating 1 gallon an acre (0.1 pound DDT) in a fine mist spray are the rule.

Heavier residual larvicidal applications with DDT emulsions (3 pounds an acre) are used in selected locations on isolated ponds. Since many of these ponds dry up in midsummer, a single application will suffice for the season. These applications result in a considerable saving in the cost per acre-week over the older oil-larviciding methods.

Major drainage works are the responsibility of the Turkish Ministry of Public Works. Since the ministries coordinate their drainage projects through this agency, drainage on a large scale for malaria control alone does not occur. It is usually tied in with such projects as land reclamation, but still the benefits extend to malaria control.

Malaria control workers are trained in the fundamentals of drainage which they apply on a local level in small hand drainage proj-

ects. The effectiveness of residual spraying in controlling malaria has largely reduced drainage operations to the maintenance of existing ditches and small channels.

### DDT Residual Spraying

Malaria in Turkey can be controlled by directing control activities only at the mosquitoes which play a role in the actual transmission of the disease. This principle of control by "species sanitation" requires a deeper understanding of the life history and habits of the vectors so that an attack can be made at a vulnerable point. The purpose of DDT spraying in homes is to control the vectors at the point where blood meals are taken from man, and where the accompanying transfer of parasites takes place, that is, in homes where humans are attacked during sleeping hours or other periods of inactivity.

The most important vectors in Turkey enter barns and houses in search of victims from which a blood meal may be taken. Sometime during this sojourn the anopheline will seek a quiet dark place in which to rest. This rest may come after its flight from the breeding area or after it has heavily gorged on the victim's blood. If DDT residues have been applied to every likely resting place, the infected mosquitoes are killed, breaking the chain of transmission.

DDT spraying on this basis has given protection to more than 9 million people each year since American aid was instituted in 1951. This assistance greatly increased the amounts of DDT available for more extensive coverage and made possible the inclusion of more villages in the operational area. Lack of adequate quantities of DDT previously limited spraying to selective spot applications within houses and also limited the number of houses to be sprayed in the selected villages. For the first time skilled DDT spraying became available for every house in each village.

An efficient spraying of all buildings at a dosage of 2 grams a square meter (214 milligrams a square foot) in each village in malaria control areas is being achieved. These buildings normally include stables, dwellings, mosques, shops, and village halls. The single

# The United States-Iraq Cooperative Health Program

By GLENN S. USHER, M.D., M.P.H.

THE objective of the United States program of public health assistance in Iraq is to help the Iraqi Government organize modern, efficient public health services in the 14 provinces (liwas) and the major cities of the country. Although this has been the objective of the program since its inception in 1952, it was only after 2½ years had elapsed that it was formalized into a 5-year plan. To achieve the objective, it was obvious that rather large numbers of public health personnel would have to be recruited and trained. It was the result of planning for this training that the 5-year plan evolved.

## Background

Iraq was formerly known to the West as Mesopotamia, which means "the land of two rivers." The country depends upon the Tigris and Euphrates Rivers for irrigation and heavy commerce.

The northern part of the country is mountainous, but in the southern part there are large marshy areas. The western part of the country forms part of the Great Arabian Desert.

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*Dr. Usher served as chief of the Public Health Division of the United States Operations Mission to Iraq from June 1952–October 1955. He is now chief of the Program Development Branch of the Division of International Health, Public Health Service.*

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Of the three main cities in the country—Basra, Baghdad, and Mosul—Basra is a port city near the Persian Gulf; Baghdad, the largest city, lies on the Tigris River in the mid-portion of the country; and Mosul is on the Tigris River in the north, away from the main lines of communication.

The climate in the central and southern areas is extremely hot in summer and mild in winter. North to Mosul and the mountains, the summer climate is less severe.

The economy of Iraq is based upon agriculture and oil resources. For the most part, agriculture is dependent upon irrigation. As a result of the slow gradient of most of the irrigated land the flow of water in irrigation ditches is sluggish. In addition, to prevent salting of the soil, drainage canals have been built to draw off the irrigation water. Such irrigation and drainage ditches provide conditions favorable for the growth of snails which serve as the intermediate host in the transmission of schistosomiasis. This disease threatens to become a serious detriment to public health unless adequate measures of prevention are incorporated in the government's plans for irrigation and drainage.

The population of Iraq, according to the 1947 census, is approximately 5 million; 700,000 live in Baghdad, 100,000 in Basra, and 150,000 in Mosul. An estimated 200,000 Bedouin nomads roam the desert region and the remainder live in small villages and other rural areas. The prevailing religion is Mohammedanism.

use of DDT in a residual spray operation has greatly accelerated the rate of decline.

The reduction in transmission has been impressive, but still there is danger of localized sporadic outbreaks so long as chronic carriers and capable vectors remain. The malaria control organization offers a nearly perfect setup for a rigid surveillance program in the years to come. Village visitations continue, with greater emphasis given to case finding. More effective treatment is in progress under a more rigid medical direction. With some villages becoming free of malaria, additional emphasis can be given to those which still have reported cases of the disease.

The conversion of the existing organization to one of general public health services is a logical sequence as malaria decreases in importance. The trend from specialized to general public health services is in the formative stage, with sanitarians gradually broadening their activities. Thus, the Turks, with characteristic energy and persistence, have all but conquered a disease which plagued their land long before their ancestors captured it.

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## Mental Defectives and Epileptics in Public Institutions

There were more than twice as many first admissions as discharges from public institutions for the mentally defective in 1954, according to the National Institute of Mental Health, Public Health Service.

New cases numbered 12,485 or 8 per 100,000 population, while 5,815 patients were discharged and 1,026 readmitted. The average daily patient load for mental defectives and epileptics combined was 138,595, with 109,931 classed as mental defectives. The range of expenditures for patient care varied considerably among the States, but the average cost per patient-year was \$1,039. Of the 157,770 patients on the institution books at the end of the year, 139,977 were listed as in residence.

The item on page 162 of the February 1956 issue incorrectly applied the figures above to public mental hospitals.



Foreign quarantine inspector at work. This service is under the direction of an American trained Iraqi physician.

ment of personnel from the Ministry of Health.

In the field of sanitation, the government, under the supervision of the Ministry of the Interior, is progressing rapidly in bringing clean water to its people. The major cities and most of the towns now have modern water treatment plants and distribution systems. However, in most of these cities and towns, personnel training and plant supervision have not yet progressed to the point where the water can be considered safe by Western standards. As a logical first step towards promoting safe water supplies for villages, the Development Board is conducting a survey of the ground waters of the country.

Less has been accomplished in developing sanitary disposal of sewage, but the government officials are acutely aware of the need and a bill has been introduced in Parliament which would

set up a commission on municipal drainage and sewerage design and construction. (The use of sanitary privies is almost unknown.)

Large numbers of villages depend for drinking purposes entirely upon irrigation water that is often highly contaminated. This water is obviously a serious health hazard.

With respect to the other aspects of public health and sanitation, the responsibility rests with the chief medical officers of the 14 liwas and the city health officers of the major cities. Such sanitation services are quite rudimentary.

### Fellowship Program

As a first step in the United States assistance program, fellowships were awarded and training courses started on an empirical basis. Soon it became evident that it was not practical to plan a training program without a concept of the type of organization one was trying to build. Therefore, a proposed organization chart was designed, and soon a proposal was drafted for the training of the personnel to staff the organization. The organization chart and the training proposal were prepared by the Ministry of Health with the assistance of consultants from the United States Operations Mission, the World Health Organization, and the British Government.

The plan encompassed the training of many types of hospital personnel as well as public health and sanitation personnel. Realistic consideration to recruitment problems and possible sources of training have also been included in the plan, and detailed job descriptions have been prepared for all of the positions.

To date, 31 fellowships for health instruction in the United States have been granted as follows: public health administration (physicians), 7; hospital administration, 6; vital statistics, 3; sanitary engineering, 2; surgery, 2; pathology, 2; ophthalmology (4-month grant), 2; and 1 each in internal medicine, obstetrics, general hygiene, anatomy, ear-nose-throat, urology, and public health laboratory. Also the following 19 health fellowships have been granted for training at the American University of Beirut in Lebanon: public health nurses, 7; sanitarians, 4; laboratory technicians, 5; and hospital administrators, 3.

The government is a constitutional monarchy with an elected parliament and several ministries presided over by a prime minister. A distinctive feature of the Iraqi Government is the Ministry of Development, whose programs of economic growth are formulated by a Development Board with the Prime Minister serving as chairman. The objective of the Development Board is to use its portion of the oil revenues to develop the agricultural and industrial potential of the country in such a way as to assure a sound economy after the oil reserves are exhausted. Seventy percent of the substantial oil revenues are allotted to the Development Board to finance its economic plans. The remaining 30 percent are allotted to the Ministry of Finance for distribution to various ministries for the normal operations of the government and for social welfare, education, and health.

### Health Conditions

Although it is known that health conditions in Iraq are not good, it is difficult to speak with precision because vital and morbidity statistics are very incompletely reported. The mortality rate is commonly estimated to be about 25 per 1,000 population and the infant mortality rate 250 per 1,000 live births.

Undoubtedly, the most prevalent diseases in the country are those which affect the intestinal tract: bacillary and amebic dysentery and worm infestation. Nutritional deficiencies are prevalent, but actual starvation is limited mostly to infants. Starvation of infants is prevalent and results from lack of knowledge about modern artificial feeding methods.

Although malaria is no longer endemic in Baghdad and the immediate vicinity, it is still a problem in the southern date- and rice-growing areas and in the northern mountains. Schistosomiasis is a serious problem in some localities and threatens to become more widespread unless appropriate precautions are taken in connection with the irrigation projects which are being planned by the Development Board.

Tuberculosis is moderately prevalent in Iraq, and trachoma causes much blindness, particularly in the villages. Endemic typhus fever occurs in Iraq, and epidemics of smallpox occur almost annually. Localized outbreaks of

diphtheria and meningococcus meningitis are sporadic. Hookworm infestation is prevalent in some areas. Bejel is widely distributed in some remote rural areas.

### Health Facilities

Of about 900 registered physicians in Iraq, 70 are foreigners. Almost all of the Iraqi physicians are graduates of the Royal College of Medicine in Baghdad. Six years of basic medical education at the college is provided free of charge by the government. In return, the graduates are obligated for 4 years of governmental service, divided among the Royal Hospital, the military service, and general practice in rural areas.

There are fewer than 600 registered nurses. About 260 are graduates of 3-year training schools, and the remainder are graduates of 1-year training courses in small hospitals.

There are about 5,000 hospital beds in the country, or 1 per 1,000 population for the country as a whole. The major portion of the hospital beds are concentrated in the city of Baghdad. However, the capital city of each liwa has a general hospital and in some instances 1 or 2 specialized or military hospitals. Free medical care is provided in more than 90 percent of them. Nevertheless, most of the hospitals are old, poorly equipped, and understaffed. Laboratory facilities in almost all of the hospitals and dispensaries are inadequate for accurate confirmation of diagnoses.

Of the dispensaries, only a few are operated by physicians. The majority are operated by "health officials" who correspond roughly to health officers in the United States, or by "dressers" who are men trained locally. Most of these dispensaries we would term first-aid stations. In some of the mountainous areas, mule-train dispensaries have been organized in an attempt to bring rudimentary medical care to the people.

In each of the 14 liwas (provinces), there is a central liwa hospital which, except in the Baghdad Liwa, is personally supervised by the chief medical officer who is administratively responsible to the governor of the liwa for all medical and public health activities within the liwa. The chief medical officer obtains his professional guidance, operating funds, and assign-





A home visit by an Iraqi public health nurse of the Basra project.

the entire liwa. Instruction is being given to public health nurses, health visitors, sanitarians, and health educators. Also assistance is being given in connection with public health administration and modern public health techniques to the Iraqi physicians who are associated with the program. When the field activities are well established, this project will serve as a center for formal training and for supervised field experience for personnel to staff similar projects in other parts of Iraq.

Thus far, the activities of the project have been concentrated largely upon health education and the training of personnel. Ten health visitors and 12 sanitarians have been trained, and the health visitors have been engaged in supervised field work for a year. For example, in the one month of May 1955 the public health nursing and health visitors' section gave service to 8 clinic sessions and 34 school health sessions,

made 1,457 home visits, and gave 19 group talks.

One accomplishment of this project has been the demonstration that a citizens health committee can organize and function effectively in Iraq, a country which has been relatively unaware of this civic progress. These committees are composed entirely of Iraqi citizens who elect their own officers and conduct their own meetings. One citizens committee has been working for almost a year. Its work will be the base for an aggressive health education program. Additional committees are organizing with the full support and encouragement of the provincial governor, the mayor, and the chief medical officer.

The sanitary engineer assigned to the project is studying conditions under which a proposed drainage and sewerage system for the city of Basra will be installed.

It is planned that there will be a central



**An American laboratory technician teaching a class of Iraqi students.**

Trainees most difficult to recruit have been those for public health administration and public health nursing. Iraqi physicians do not consider positions in public health administration financially attractive. It is also difficult to recruit for public health nursing because few graduate nurses want to take the training and few are sufficiently proficient in the English language to benefit from courses offered by the United States. Proficiency in English is essential because there are no schools of public health nursing where the instruction is given in Arabic. The teaching in the public health school at the American University of Beirut is in English.

Nurse training at the Royal Hospital, the only governmentally recognized 3-year nursing school in the country, is conducted in Arabic.

The ministry is attempting to break these bottlenecks by providing better pay for full-time public health physicians and by establishing a new nursing school. Such a school will be established with our assistance in the near future. Instruction will be given in English in the new school, and eventually instruction in nursing will be in English instead of Arabic since

there is little professional Arabic literature in the field of nursing.

All Iraqi personnel who complete courses of training either under fellowships or in the co-operative projects described below are followed up to see that they are properly placed and that their newly acquired skills are fully utilized. In addition, the physicians who have studied public health administration meet regularly as a group to discuss Iraq's public health problems and to seek solutions to the difficulties they are encountering in applying the techniques they have learned.

In all training programs it is as important to provide appropriate orientation toward democratic public health objectives for administrative leaders as it is to train professional and semiprofessional workers to do the field work. Without sympathetic and intelligent administrative leadership, the field workers cannot be fully effective however well trained they are. Therefore, a policy has been adopted of providing grants to high ranking Iraqi public health officials to enable them to visit America for carefully planned and supervised tours of American institutions and for conferences with American leaders in various fields of public health and medical care.

### **Basra Demonstration Project**

In addition to grants and fellowships, the program provides on-the-scene training through a variety of demonstration projects.

At Basra, near the Persian Gulf, the ministry is being assisted in establishing a public health demonstration and training project. The purpose of this project is to set up, in this one liwa, a public health organization like the one envisioned in the 5-year plan.

American personnel with Iraqi counterparts fill the positions of senior health officer, sanitary engineer, sanitarian, public health nurse, and health educator. An Iraqi epidemiologist also has been provided, and the ministry has assigned three Iraqi public health nurses who were trained under our fellowship program at the American University of Beirut.

Iraqi personnel are being trained, and as they become proficient in their duties the project activities will be expanded until they take in



A home visit by an Iraqi public health nurse of the Basra project.

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The sanitary engineer assigned to the project is studying conditions under which a proposed drainage and sewerage system for the city of Basra will be installed.

It is planned that there will be a central

health center in the city of Basra which, in addition to providing clinical health services for the people of the immediate vicinity, will provide offices for the liwa health personnel. Branch health centers will be located in the various communities of the liwa in such a way that they will be accessible to the entire population.

### **Environmental Sanitation Project**

An American sanitary engineer has been assigned to the Ministry of Health in order to give substance to its department of sanitation.

Initially, this engineer devoted the greater portion of his time to the city of Baghdad. He supervised and trained the city's sanitarians and revised and strengthened the city's program of sanitation of public eating places. A food handlers' school was established, and instruction has been given to 850 food handlers. The engineer introduced an educational approach to restaurant inspections. In addition, he provided consultation on many aspects of the city's sanitation problems. City authorities were persuaded to operate a sanitary landfill for garbage disposal. Improved design and supervision were introduced in the construction of cesspools and septic tanks by private contractors. Practices at milk pasteurization plants were improved.

Baghdad has now acquired a well-trained Iraqi sanitary engineer who has assumed these responsibilities although our sanitary engineer continues to give guidance and technical advice. Outside of Baghdad, requests for his assistance thus far have been mostly in connection with drainage and sewage disposal problems. Plans for expansion of his activities are under consideration.

### **Hospital Facilities Project**

The Iraqi Government intends to launch a hospital and health center construction program which will cost \$20 or \$30 million or possibly more. Since Iraq lacks the specialized personnel required to plan an efficient hospital system or to design modern hospitals, a hospital architect and a hospital administrator have been assigned to the Ministry of Health by

the United States Operations Mission. At present, they are engaged in functional studies, preliminary sketches, and cost estimates for a new Royal Medical Center (referred to locally as Medical Town) to replace the present Royal Hospital. This will include an 850-bed government hospital, a 150-bed private hospital, a central building for the Royal Medical College, and a nursing school. It is estimated that the project will cost about \$12 million.

The role of the American team is (a) to make preliminary functional studies of the proposed buildings; (b) to represent "the client" (the Ministry of Health) in negotiations of contracts with architectural firms for the production of working drawings and specifications and the supervision of construction; and (c) to represent the client in relation to the smaller projects which are designed and constructed by Iraq's Department of Public Works.

The hospital administrator assigned to the project is directly concerned with the portion of the ministry's 5-year plan that deals with the training of hospital personnel. Of special concern to him are the Iraqi personnel who have completed training in hospital administration either in the United States or at the university in Beirut. He helps with the placement of these personnel in appropriate positions and keeps in close contact with them during the period of adjustment to their new duties. It is expected that these former trainees, under the guidance of the American hospital administrator, will spearhead the improvement of hospital administration practice in Iraq.

### **Village Life Improvement**

One program of the United States mission cuts across the various technical specialties and aims to bring about improvement in all aspects of the living standards in the villages of Iraq. Public health has an important role with respect to improvement of water supply and village sanitation, control of disease vectors, and home hygiene services.

This program is one of several types which are referred to as "impact programs." Its objective is to carry some of the simple benefits of modern technology more directly to the villagers than can usually be done through the nor-

mal operations of government agencies. Iraqi personnel are trained and then assigned to live in the villages and show the inhabitants how to improve their living conditions.

The Iraqi "rural affairs officers," who are being trained under this program, are known as multiple purpose workers. Sanitation and hygiene are important subjects in their training course, which also includes some simple methods of improving agricultural practices, homemaking, child care, and road building.

Two other projects are in operation at present. The first is the maternal and child health demonstration and training project, which has been reported in detail in *Children*, volume 2, March-April, 1955. The second project, recently instigated with American assistance, is a school for laboratory technicians.

#### Comments

The region which is now Iraq has been the abode of some of the world's oldest and proudest civilizations. It was the breadbasket of the Babylonian and the Moslem Empires. Its soil has provided a prosperous living for populations estimated as high as 40 million.

However, the Mongol invasions decimated the population and destroyed the elaborate irrigation system upon which the livelihood of the people depended. These invasions struck the civilization of the area with what Toynbee would call an "overwhelming challenge." The following four centuries (since 1517), under Ottoman rule, drained the people of their initiative and ambition and instilled in them a deep, abiding distrust of centralized government. In response, they devised a form of subsistence living which made it possible for them to survive under the most adverse conditions.

Since Iraq's liberation in the First World War, the country has, with British assistance,

made much progress in reviving the art of self-government (parliamentary), but much remains to be done to improve the standards of living of the common people. In recent years the new revenues derived from the exploitation of the country's oil resources give hope of a rapid acceleration in the achievement of this objective.

The United States offer of the services of experienced American personnel aims to help rehabilitate the nation's economy and assist in bringing better living conditions to the people. The Government of Iraq has welcomed this assistance and has sincerely tried to carry out its part of the cooperative agreements. That it has not been entirely successful in this is due to various factors which include: (a) its inadequate fiscal and personnel systems, which impose formidable administrative barriers; (b) the narrow base of the country's educational system, restricting opportunity, especially for girls, with the resultant scarcity of qualified candidates for training; (c) frequent and numerous cabinet changes in recent years; and (d) the great flood of the spring of 1954.

Despite these handicaps substantial progress has been made with the public health program. The public health program has been chiefly a "pump-priming" operation to encourage the granting of appropriate emphasis to preventive medicine and sanitation in the country's economic plans. The country has sufficient resources to permit it to support a completely modern medical and public health establishment. The problem has been to avoid allowing the public demand for curative medical facilities to overemphasize personal medical care at the expense of public health facilities needed.

Progress to date has been gratifying, and for the future there is justification for increased optimism as confidence in, and respect for, public health services take hold.



# technical publications

## The Engineer in the U. S. Public Health Service

*Public Health Service Publication No. 455. 1955. 20 pages.*

This illustrated brochure for the recruitment of sanitary engineers describes the wide variety of activities of the commissioned engineer officer in the Public Health Service. Qualified sanitary engineers are invited to join the Service and share in its 150-year-old tradition and progress.

Discussed are the many opportunities the Service offers in the field of environmental sanitation—water supply, waste disposal, milk and food, vector control, and the challenging new fields of air pollution and radiological health.

The various facilities including the Robert A. Taft Sanitary Engineering Center, the largest research institution in the field, are depicted. Opportunities for service overseas with the United States health missions are explained.

The booklet also delineates the role of the engineer members of the Public Health Service Commissioned Reserve in meeting emergency national health problems.

## Biological Products, Revised, 1955

*Public Health Service Publication No. 50. 1955. 48 pages. 20 cents.*

Superseding Miscellaneous Publication No. 39, this publication lists establishments holding licenses for the preparation and sale of viruses, serums, toxins and analogous prod-

ucts, and the trivalent organic arsenic compounds.

The licenses granted establishments for the products specified do not imply an endorsement of the preparations. A licensed establishment is inspected regularly for personnel technical ability and sanitary condition of premises. In addition, manufacturing methods must be adjudged safe, and the establishment must meet requirements, specified by the Division of Biologics Standards of the National Institutes of Health, designed to insure the continued safety, purity, and potency of products.

## Sources of Morbidity Data, Listing Number 3. 1955.

*Public Health Service Publication No. 459. 99 pages.*

The third listing of projects in the files of the Clearinghouse on Current Morbidity Statistics Projects contains descriptions of 145 projects, supplementing the 332 described in listings No. 1 and 2 (Public Health Service Publications 332 and 399).

Listing No. 3 has a section of supplementary notes on projects in listings No. 1 and 2, that represent a systematic followup on all projects in the two listings that were in progress when their descriptions were received by the clearinghouse.

In listing No. 3 there is an index by type of data collection, also an alphabetical list of principal investigators, and, for the first time, an index of organizations and institutions participating in the projects.

Because the listings of the clearinghouse are published primarily for the use of actual and potential contributors, the number of bound copies available for other distribution is limited. Tear sheets for all projects are on file, however, and these will be mailed free of charge to persons inquiring about studies of a particular type.

## NIDR Current Clinical Studies and Patient Referral Procedures at the Clinical Center

*Public Health Service Publication No. 456. 1955. 8 pages.*

Described in this pamphlet are current clinical studies of the National Institute of Dental Research and the types of patients desired for participation in these studies.

It is intended as an aid to dentists and to others in dental schools, clinics, and health services who wish to refer patients to the institute for study and treatment at the Clinical Center in Bethesda, Md. Also explained is the procedure for referral of patients and the requirements for admission to the Clinical Center.

This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

# Cardiovascular Disease Programs for the Community

By WILLIAM J. ZUKEL, M.D., HERMAN E. HILLEBOE, M.D., and JOSEPH T. DOYLE, M.D.

THE COMMUNITY expects leadership from the health officer in solving its major health problems; these may be infectious diseases in one area or chronic diseases in another, or both in many areas. The growing problem of cardiovascular disease, which is now responsible for more deaths in the United States than all other diseases combined, should challenge the best efforts of every health officer to seek counter measures. In New York State during 1954, for instance, cardiovascular disease was given as the cause of more than half of all deaths (see table).

Ultimate death, of course, cannot be avoided, but premature death, unnecessary suffering, and disability can often be prevented. The First National Conference on Cardiovascular Diseases (1a) in 1950 brought out the need to apply existing knowledge of cardiovascular disease control; at the same time, it was recognized that continued research is of prime importance. Much is yet to be learned about effective measures for controlling cardiovascular disease; however, the considerable experience and new

knowledge that have accumulated indicate promising tangible activities.

More than 50 diseases are known to produce myocarditis as a major or associated complicating illness (2,3). These include rheumatic fever, diphtheria, rickettsial disease, syphilis, tuberculosis, meningococcemia, leptospirosis, trichiniasis, tularemia, and brucellosis. Most of these diseases have been responding well to public health measures. Rheumatic fever, too, could be removed from its place as third most common cause of heart disease by the concerted effort of private and public health physicians. Effective use of present knowledge of prevention and the early treatment of streptococcal infections could make the disease a rarity.

Atherosclerosis and hypertension remain the greatest heart problems. But even with these, there is reason for optimism that research efforts will provide at least partial measures for control in the foreseeable future.

Since the scope of the cardiovascular disease problem is so broad, every health officer can find some area for positive action. How much is accomplished may depend more on the interest and activity he can stimulate within the local medical profession and in the community than on the size of his staff or budget. Physicians will support services that benefit the patient, if these services do not infringe on physician-patient relationships. By working with the physicians, the local heart association, community leaders, and representatives of community agencies, a thoughtful appraisal can be made of community needs and a program developed to meet these needs. Although measures to meet specific needs in cardiovascular

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disease are in themselves important, they should relate as well to other chronic diseases in the community.

Although no two communities are identical, there are several activities applicable in most communities. Some involve action on present knowledge; others would entail studies to add to our information (see outline). A review of some of these activities follows.

### Primary Prevention

Specific measures directed toward the prevention of infectious diseases, such as diphtheria, syphilis, and tuberculosis, should be applied at every opportunity. The drama of preventive measures may not match that of surgical correction of congenital anomalies, but the value of prevention is unquestionable and lasting. There are sound recommendations for the primary prevention of cardiovascular disease in the reports of the First National Conference on Cardiovascular Diseases (1*b*) and of the Chronic Illness Commission (4). Certain aspects are worthy of review here.

#### *Congenital Heart Disease*

Congenital heart disease is far from being a rare condition. Richards and associates (5) in a careful study of an unselected series of 6,053 births found 50 cases of congenital cardiovascular malformations, an incidence of 0.83 percent. Twenty-nine of the fifty cases survived 1 year, representing 0.5 percent of the total study group surviving that long. In some school surveys, congenital heart disease has been as prevalent as rheumatic heart disease (6, 7).

Of recognized public health importance is the relationship of maternal rubella infections during the first trimester of pregnancy to the development of anomalies in the fetus (8). The estimates of 100 percent risk (9) of anomalies from rubella occurring during the first 2 months of pregnancy appear to be too high, and a figure closer to 20 percent (10) is a more realistic estimate from prospective studies. Nevertheless, the gravity of the consequences has been considered by some to be justifiable reason for therapeutic abortion in women who contract rubella during the first 3 months of pregnancy (1*b*, 11).

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### Program Activities for Cardiovascular Disease

Prevention: primary and secondary

Community research

Education and information

Detection programs

Diagnostic services

Ancillary services: nursing, nutrition, medical social, physical therapy, vocational guidance, laboratory

Nursing homes, convalescent homes, home care

Rehabilitation

Evaluation

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The American Public Health Association (12) and the Committee on Immunization and Therapeutic Procedures for Acute Infectious Diseases of the American Academy of Pediatrics (13) are in agreement on basic recommendations regarding rubella and birth anomalies. Essentially they are: Girls in good health should not be protected from exposure to rubella before puberty since permanent immunity usually follows the disease. Women in the first 4 months of pregnancy should avoid exposure to rubella if possible. Gamma globulin should be administered to women who are exposed to rubella during the first 4 months of pregnancy to provide the possible protection afforded by the induced passive immunity.

The dosage of gamma globulin presently recommended by the New York State Department of Health for intramuscular administration is from 0.2 cc. per pound of body weight to a maximum dose of 20 cc., preferably containing material from two different lots (14). This is based on the finding that the titer of rubella antibodies may vary with different lots of pooled gamma globulin (15) and that the higher dosage should be more effective in preventing rubella.

Other viral diseases during the first trimester of pregnancy have been incriminated as causing fetal anomalies, but the relationship is not yet established. Herpes simplex during the first trimester had a suggestive but perhaps coincidental relationship to the development of the tetrad of Fallot in Richards' study (5). Mumps, measles, varicella, poliomyelitis, infec-



tious mononucleosis, influenza, herpes zoster, and virus pneumonia during the first trimester of pregnancy are mentioned as reported causes of fetal anomalies in collected cases of Kaye and associates (16). Dietary deficiencies in the mother during early pregnancy suggest an association with a higher incidence of fetal anomalies, but the relationship is difficult to prove (17). Prospective studies will be needed to establish the validity of these observations.

Experimental animal studies and accumulated clinical evidence reveal that congenital anomalies in the embryo and fetus can result from extensive pelvic irradiation (18-20). Current practice usually recognizes this potential danger and elective, prolonged X-ray studies are avoided during pregnancy. Russell and Russell (19) concluded from animal studies that roentgen dosages well within the range used in diagnostic fluoroscopy might cause subtle alterations in the fetus if exposure occurred at a critical time. They recommend that irradiation of the uterus in women of child-bearing age be restricted to the 2 weeks following the last menstrual cycle to preclude the possibility of irradiation after fertilization has taken place.

Even with its limitations, our current knowledge gives encouragement that other factors might be revealed as causative agents in congenital heart disease. The epidemiological approach toward determining such possible factors is a sound one.

### *Rheumatic Fever*

Present knowledge indicates that rheumatic fever has become a preventable disease. Several studies have shown that first attacks of rheumatic fever can be prevented when the initiating streptococcal infection is diagnosed and promptly treated with penicillin (21-23). For acute streptococcal infections, a single injection of 600,000 units of long-acting benzathine penicillin G is effective. Among 1,175 children with streptococcal infections treated with this regimen by Breese and Disney (23), no clinical rheumatic fever or acute glomerulonephritis was noted in the entire series. An attack rate of clinical rheumatic fever of perhaps 3 to 5 percent might have been expected without such treatment (24, 25). Any other dosage regimen

of penicillin is acceptable if it maintains bactericidal levels of the drug in the individual over a period of at least 8 to 10 days (26). Treatment of acute streptococcal infections with sulfadiazine has not been effective in preventing subsequent rheumatic fever (27). Sulfonamides are, however, of value as a daily prophylactic measure for known rheumatics in preventing streptococcal infections that might result in recurrence of rheumatic fever (26, 27).

A youngster who has a history of rheumatic fever may have as high as a 50 percent chance of developing a recurrence of rheumatic fever if he develops a new streptococcal infection (28). It appears that it would be advisable for persons with a history of rheumatic fever to be placed on a continuous prophylactic regimen for a period of at least 5 years from the last attack. In a report by Bland and Jones (29) on 1,000 patients with rheumatic fever and rheumatic heart disease followed for 20 years, the recurrence rate in the preprophylaxis era was approximately 1 in 5 per year during the first 5 years, 1 in 10 per year during the next 5 years, 1 in 20 during the third 5-year

**Deaths and death rates per 100,000 population, New York State, 1954**

Cause	Number	Rate
All causes.....	159, 540	1011. 7
Cardiovascular diseases.....	89, 275	566. 1
Vascular lesions affecting the central nervous system.....	14, 036	89. 0
Diseases of the heart.....	70, 615	447. 8
Chronic rheumatic heart disease and rheumatic fever.....	2, 472	15. 7
Arteriosclerotic heart disease including coronary disease.....	53, 186	337. 3
Nonrheumatic chronic endocarditis and other myocardial degeneration.....	6, 479	41. 1
Hypertension with heart disease.....	7, 932	50. 3
Other diseases of the heart.....	546	3. 5
Hypertension without mention of heart disease.....	996	6. 3
General arteriosclerosis.....	2, 740	17. 4
Other diseases of circulatory system.....	888	5. 6
Tuberculosis.....	1, 829	11. 6
Malignant neoplasms.....	29, 392	186. 4
Accidents.....	6, 503	41. 2
Poliomyelitis.....	99	. 6
All other causes.....	32, 412	205. 7

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interval, and 1 in 70 in the last 5-year interval. Acceptable methods of prophylaxis are oral sulfadiazine, 0.5 to 1.0 gram daily, or daily oral penicillin of 200,000 to 400,000 units, or a monthly intramuscular injection of 1.2 million units of benzathine penicillin G. Specific recommendations for dosage have been formulated by the Council on Rheumatic Fever and Congenital Heart Disease of the American Heart Association (26). They form a sound medical basis for a community program for the prevention of rheumatic fever.

A practical problem in such community programs has been to maintain faithful adherence to the long-term schedule of prophylaxis. The health department is uniquely able to help the physician with this problem by providing a followup service, especially through public health nurses. In some communities the health department serves as the focal point for distributing the drugs ordered by physicians (30). A roster of patients can be kept, the regularity of refill of prescriptions can be noted, and lapses from treatment more readily detected and prevented. Other communities have found that the school can serve as a focal point for carrying out the physician's prescribed regimen. This has worked successfully in Cortland County, N. Y., where such a program has operated for the past 5 years. Success in preventing rheumatic fever will depend on the faithfulness with which long-term services are maintained. Recurrences of rheumatic fever should be reduced by at least 85 percent if an adequate regimen of sulfa or penicillin prophylaxis is followed (21, 31).

#### *Subacute Bacterial Endocarditis*

A serious complication of congenital, rheumatic, or other valvular heart disease is subacute bacterial endocarditis. This disease carried a fatality rate of almost 100 percent before the use of antibiotics. Now a cure rate of approximately 75 percent is possible with proper treatment (32), but irreparable damage to the heart valves proceeds unless the invading organisms are destroyed. This disease is almost certainly preventable when prophylactic doses of antibiotics are given to persons with congenital, rheumatic, or other valvular heart disease prior to and during any operative pro-

cedure that might produce bacteremia. Common surgical procedures which may result in subacute bacterial endocarditis in persons with valvular or congenital heart disease include dental extractions; surgery about the mouth, nose, and throat; genitourinary operations; and obstetrical deliveries. Published recommendations of the Council on Rheumatic Fever and Congenital Heart Disease are good guides to follow (26). The routine application of this knowledge by physicians and dentists pays full dividends. The methods of accomplishing this can be worked out with professional groups in the community.

#### *Coronary Artery Disease*

Coronary artery or atherosclerotic heart disease cannot be prevented as yet; however, there is evidence that it is not an unalterable process (33, 34). Katz (35) has reported that early lesions of experimental atherosclerosis in the chick and in the rat can be reversed by estrogen therapy. Stare and his co-workers (36) are currently studying whether dietary alterations will reverse experimental atherosclerosis induced in Cebus monkeys.

Keys and his co-workers (37) have contributed additional knowledge that lends encouragement for the future understanding of the mechanisms of atherosclerosis. Population groups such as our own, with an average diet containing 40 percent of the calories as fats, are said to have more coronary artery disease than do population groups such as the Japanese and Bantus whose diets contain less than 20 percent of caloric intake as fat (38). Women before the menopause have appreciably less atherosclerosis (39) than do men even though they presumably have much the same diet.

As yet the data relating to diet and atherosclerosis are not conclusive enough to warrant a specific program for attempting to change diet patterns of the general public. However, for individual patients with coronary artery disease, physicians are increasingly tending to prescribe diets low in total calories and relatively low in animal fat content. The usual range of cholesterol intake in humans apparently does not affect appreciably the serum cholesterol level (40, 41). Animal fat, such as lard, produces a significant rise in human serum

cholesterol whereas corn oil substituted at the same caloric level results in a fall in serum cholesterol (42). The differing effects on serum cholesterol of animal fats and vegetable fats are being studied further (42, 43).

Physicians are finding that good nutrition services in the community are becoming as much of a need as are adequate dietary services within the hospital. Health departments can provide such services in the community through nutritionists and public health nurses trained in diet interpretation.

### *Hypertension*

The etiology of hypertension is still unknown although many factors have been implicated in a complex interrelationship of possible causes. Some of these are the sodium ion, adrenal and pituitary hormones, neurogenic factors, and renal pressor mechanisms involving renin and other pressor factors (44, 45). Observations have been made of a frequent association of obesity and hypertension (46). While no causal relationship is claimed, it is accepted clinical practice to advise weight reduction for obese hypertensive patients (45). A favorable effect of such weight reduction on the elevated blood pressure has been demonstrated, and this is not an artifact induced by change of girth of the arm (47). Obese individuals with labile high blood pressure have a greater probability of later developing persistent hypertension than do persons who are not overweight (48).

It seems that obesity control should be part of the basic teaching of good nutrition habits early in life and profitably could begin in the elementary schools. Considerable experience has accumulated on techniques for weight reduction of obese individuals, but maintaining the achieved reduced weight level is probably the most difficult prescription to follow in all medical practice (49, 50). The physician interested in nutritional guidance for obesity control can obtain nutrition consultation services through his State and local departments of health.

### **Secondary Prevention**

Cardiovascular diseases will likely be with us for some time to come, so we should learn

to live with them with a minimum of discomfort and disability. The continuing counsel, supervision, or treatment by a well-informed physician is the only measure known for delaying the course of the disease and preventing unnecessary complications. Both emotional and physical disability can be prevented or postponed in many ways.

Attitudes of employers, of family members, and of close associates influence the reactions of the person with heart disease toward his condition. Thus, members of the community can help reflect the increasing optimism of the medical outlook for cardiovascular disease. Fortunately, publicity and educational information regarding heart disease have, in general, avoided the fear approach; this is a sound policy to continue.

The prevention of recurrences of rheumatic fever has already been discussed. Measures for preventing the progression of congestive heart failure and for preventing sequelae of cerebral vascular disease are other community services that will aid physicians and patients alike. The common complications and disability from peripheral vascular disease also present a challenge, but present knowledge of preventive measures is limited. Rehabilitation is especially indicated for these conditions.

### *Congestive Heart Failure*

A cursory survey of the cardiac patients in any general hospital will reveal some who are repeated visitors because of recurrent episodes of congestive heart failure. Gold (51a) found that 20 percent of congestive failure patients in a hospital had multiple admissions for the same reason. These are not as a rule the intractable patients about whom much is written but who comprise only a fraction of this group. Most of these patients have merely lapsed from an initially adequate regimen of digitalis, sodium restriction, and diuretics. Since the symptoms of congestive failure are insidious in development, the patient may be gradually accumulating edema without distress over a period of weeks before the acute episode of failure suddenly develops. This type of progression can ordinarily be prevented.

A patient who has recovered from one epi-

sode of cardiac failure can often be maintained in compensation for several years on a suitable regimen of digitalis, sodium restriction, mercurials as needed, and moderate physical activities (52). The routine is less complicated than that required for regulating a diabetic on diet and insulin. Diabetic coma is regarded as an unforgivable lapse of medical management, while acute congestive failure is shrugged off as inevitable in an "uncooperative" patient. Leiter (51b) found that one of the main reasons for poor results even in the hands of experienced physicians was incorrect diet. The physician who takes the time to educate his patient has little difficulty in maintaining the patient free of decompensation. The intricacies of the low sodium diet require that the patient learn to select foods and beverages of low sodium content and to avoid products containing sodium such as seltzer tonics and most laxatives.

Special classes (53) by dietitians, nutritionists, or public health nurses have been organized to give patients practical information regarding the low sodium diet. Patients referred to such classes by their physicians have benefited both in the exchange of information on ways to make the diet appetizing and also in the mutual feeling of support which comes from knowing that others face the same problems.

Public health nurses already are giving mercurials or diet instruction on request of physicians to a number of congestive heart failure patients who are homebound. This type of service could well be extended. Since more than half (54) of the individuals with organic heart disease may develop congestive heart failure, a program that assures optimum long-term treatment would return dividends in economic savings and in the prevention of unnecessary disability.

#### *Cerebral Vascular Lesions*

It is estimated that more than 1.8 million persons in the United States are disabled by cerebral vascular lesions (55). The majority of these are elderly individuals who have suffered a cerebral thrombosis with resulting hemiplegia. A small proportion of the disabilities are the result of cerebral embolism following rheumatic heart disease with auricular fibrillation, or of an embolus developing from a mural

thrombus after a myocardial infarction. Other uncommon disorders may also result in hemiplegia. Very few persons with intracerebral hemorrhage survive; therefore, thrombosis or embolism is usually the underlying factor in surviving hemiplegics.

Long-term anticoagulant therapy has been effective in reducing recurrences of thromboembolism in rheumatic heart disease with auricular fibrillation and a history of previous embolism (56). Studies of the use of long-term anticoagulant therapy for persons who have had cerebral thrombosis are in progress, and there is some indication that basilar artery thrombosis may be prevented by anticoagulants when administered during early stages of basilar artery insufficiency (57). Adequate laboratory facilities must be available in the community to provide reliable prothrombin determinations for physicians who wish to use the effective but potentially dangerous drugs such as dicumarol, tromexan, or similar anticoagulants.

The prevention of unnecessary disability in hemiplegics is a complex problem that requires many community health services. These patients may live for several years with alert minds trapped in dysfunctioning bodies. The speech handicaps of aphasics are particularly difficult since the patients may understand everything spoken to them but are unable to express their comprehension in words. Speech therapists are scarce in the average community. However, interested school teachers could use the instruction material (58, 59) that is available for teaching aphasics and contribute invaluable help in this aspect of the problem.

The physical therapist is the major contributor toward the physical reeducation of the hemiplegic. Destroyed function cannot be restored, but in many instances enough function remains in unaffected muscles to allow retraining for performance of basic activities. The physiatrist should be called in soon after the onset of illness to outline the physical therapy required. Rehabilitation centers that are being developed in many States will help meet the needs of hemiplegic patients; however, most communities must depend on their own resources.

The extent of disability and economic loss from peripheral vascular disease is not known, but estimates indicate it is considerable. Long-suffering patients with gangrene of the toes or indolent ulcers are commonly seen in hospital wards. Too often a series of amputations of increasingly serious magnitude follow in rapid succession. Arteriosclerotic peripheral vascular disease, varicose veins, thrombophlebitis, phlebothrombosis, thromboangiitis obliterans, Raynaud's disease, frostbite, and immersion foot are some of the more common of the peripheral vascular disease problems.

Early recognition of the disease and medical supervision are important in preventing complications in these patients. Meticulous regulation of diabetes is of great importance as is avoidance of mechanical, thermal, or chemical trauma to the extremities (60). Prevention and adequate treatment of bacterial and fungal infections, regular foot hygiene, and abstinence from smoking are other measures of general value. Instruction of diabetics in daily foot care is becoming more effective as physicians realize the importance of preventive measures. Public health nurses are also contributing further to this education through the increasing number of diabetic patients physicians are requesting them to see. The potential scope for such educational activities is seen from the fact that 20,300 public health nursing visits were made to diabetics in upstate New York during 1954 (61).

Educational materials on foot care used for diabetics should be equally useful for patients with other peripheral vascular diseases. The use of preventive measures of this type as found in standard texts (60) is a practical starting place in preventing the progression of disability from peripheral vascular disease.

### **Community Research**

The research laboratory is traditionally expected to discover the etiology of diseases and develop appropriate therapeutic measures. However, it is well known that epidemiological studies provided knowledge for effective control of several important diseases long before the etiological factors were identified. In-

cluded are pellagra, endemic goiter, scurvy, dental caries, and retrolental fibroplasia. Epidemiological studies have demonstrated the relationship of group A beta hemolytic streptococcal infections to the subsequent development of rheumatic fever (62); the same is true of the effect of rubella on congenital heart disease during the first trimester of pregnancy. Although epidemiological studies of coronary artery disease and of hypertension are now gaining more attention, further studies are needed to determine additional factors associated with their prevention.

Elaborate research studies are out of the question for many communities, but modest field studies are feasible in most communities, especially those with a good health department. Here are some examples of problems needing further study by community groups. It has been a clinical impression that farmers, lumberjacks, and manual laborers have less coronary artery disease than do city dwellers (63). It has been suggested in studies by Morris and associates (64) that occupational groups who perform heavy physical work have lesser amounts of severe coronary disease than do sedentary groups. Other factors incriminated without adequate confirmation are diets that are high in total calories or high in total fat (34) or cholesterol foods such as milk and eggs (65), cigarette smoking (66), and the stress of modern living (67).

Carefully designed studies are needed to test and confirm these theories, and such studies will have to be done at the community level. Industries with good medical departments can contribute valuable studies which attempt to relate occupational factors to coronary artery disease and hypertension. The work of Crain and associates (68) on the incidence and prognosis of myocardial infarction among employees lends optimism to the outlook for continued employability of persons who develop coronary artery disease. The economic loss to the community resulting from heart disease is of practical importance but has not been thoroughly studied. The incidence and prognosis of heart disease in the general population in different parts of the country are still unknown for both coronary and hypertensive vascular disease.

A comprehensive study of major factors related to coronary artery disease and hypertensive vascular disease is now in progress at the Cardiovascular Health Center (69, 70) in Albany, N. Y., but less elaborate studies in the community could give valuable information on some aspects of these problems. A health officer can interest private physicians in the many facets of the heart disease problem by developing a study that will provide new knowledge on the local heart disease problem. Many resources are available to help plan and carry out local studies. These include the universities, the State departments of health, the American Heart Association, and the Public Health Service.

### Education and Information

The extent of knowledge about heart disease directly influences the effectiveness of community efforts directed toward the problem. This level of knowledge includes that of practicing physicians, nurses, social workers, vocational counselors, employers, and patients and their families. Professionals, nonprofessionals, and members of the general public are concerned with some aspects of the problem, even if it is merely from personal or family experiences.

The health officer should become involved in health educational activities to the full extent of his ability and resources. Postgraduate education for physicians is a specialized form of health education and is usually best carried on through the regular channels of the medical society, medical schools, and hospitals. The health officer and local heart association, however, can often bring in special speakers or teaching aids such as films, tape recordings, or other materials that are available and continually being developed by medical schools, the American Heart Association, the Public Health Service, and other organizations. The New York State Department of Health, like several other State health departments, maintains a library of health films that are available on loan to professional and nonprofessional groups.

Information on heart disease is essential for public health nurses, nutritionists, physical therapists, medical social workers, or any other

individuals who might be brought into heart program activities. The quality of service can be only as good as the caliber of personnel and level of their knowledge concerning their possible contributions to the problem.

The judicious use of educational information for the public can be helpful when specific program activities are being developed. It would be wise to have a medical advisory committee determine the general approach to be used in acquainting the public with health information since unsuitable materials may only stimulate fear of heart disease rather than constructive attitudes or action. People do not automatically accept health programs merely from the presentation of scientific evidence. Attitudes, beliefs, values, traditions, and many other factors influence their willingness to accept or undertake actions related to their health (71, 72). The health educator who understands the problems related to heart disease can be very helpful in developing program activities in the community. Through various processes of communication, medical knowledge can be transformed into public understanding and acceptance of specific health activities, for example, prevention of rheumatic fever, early detection of heart disease, and rehabilitation.

The local health department and local branch of the American Heart Association will do the best possible job of health education if they combine their resources in personnel and mass media and conduct a joint program of health education on a continuing basis.

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## Change in Name of Institute

The National Microbiological Institute, one of the seven National Institutes of Health, Public Health Service, was redesignated the National Institute of Allergy and Infectious Diseases early in February 1956. Dr. Victor H. Haas is director of the institute.

The renaming of the institute reflects the importance of new research on allergies and the close relationship of such research with the study of infectious diseases. Investigations of allergy are closely allied to the science of immunology, which is also fundamental to investigation of the infectious and parasitic diseases. Recent estimates indicate that approximately 16 million persons in the United States suffer from some form of allergy and that some manifestation of allergy is experienced by at least 50 percent of all people at some time in their lives.

The institute will support long-term basic studies in these fields through grants to research scientists in universities and medical schools. A National Advisory Allergy and Infectious Diseases Council has been established to make recommendations to the Surgeon General of the Public Health Service regarding the new grant activities of the institute. The council held its first meeting March 7-8, 1956, at Bethesda, Md.

Members of the council are leaders in science, education, and public affairs. Except for two vacancies to be filled, all the members have been appointed. They are:

Drs. René J. Dubos, member of the Rockefeller Institute for Medical Research, New York; Gail M. Dack, director, Food Research Institute, University of Chicago; Edwin B. Fred, president, University of Wisconsin; Charles E. Smith, dean, School of Public Health, University of California at Berkeley; and H. O. Halvorson, head, department of bacteriology, University of Illinois.

Byron H. Larabee, president, Firestone Plantations Company, Akron, Ohio; David C. Crockett, associate director, Massachusetts General Hospital, Boston; Mrs. Rollin Brown, of Los Angeles, president, National Congress of Parents and Teachers; and John Abbink, of New York, president, American Foundation for Tropical Medicine.

# Dynamic Impact of Advancing Technology on Environment and Health

By MARK D. HOLLIS

WITHIN the short period of 50 years, Western civilization has compressed more major technological changes than had occurred in all its previous 2,000 years. Since 1900 we have witnessed the birth of the automotive age, of aviation, and of mass production techniques. Developments in electronics, chemotherapy, and jet propulsion have appeared since 1930. Synthetics—apart from celluloid and bakelite, almost unknown in 1930—are now commonplace. More than a half million synthetic compounds are in production and use—in construction, in household products, in clothing, and in foods. We often speak of the 900-percent increase in industrial production since 1900 without noting that more than half of this increase has occurred since 1940. And now, to all of this, is added nuclear energy—the atomic age with its fantastic potential for good and for evil.

But by all signs, this is only the beginning. Already on the horizon are such techniques as irradiation of foods, rocket transportation, electrification of solar energy (now operating

a telephone circuit in Georgia), and a host of other potentials.

## Attitudes Concerning Change

One thing is clear: In your life span there will be an avalanche of change such as we have never known.

Much of the world is unaware of what is in its grasp. I returned last month from a trip through several of the areas of the world which have been barely touched by technical advances, if at all. To me the striking characteristic in these countries was not their primitive sanitation but their inertia toward change. One senses a hopeless resignation to the open sewers and open sores, to the appalling rates of infant mortality, to decrepit old age at 40, to acceptance of drudgery, disease, and despair. We in the United States, always a Nation of restless pioneers, generation by generation, have displayed no vested interest or ingrained habits that compel us to do things in old ways, if new ways are better. Oscar Wilde said: "The longer I live the more keenly I feel that whatever was good enough for our fathers is not good enough for us."

It is this heritage that makes possible new developments so swiftly achieved that we have little time to adjust our minds to the changes and to understand their full significance. The tenor of the times is reflected in our increased living pace—at home, at work, and at play.

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Mr. Hollis is Assistant Surgeon General and chief engineer of the Public Health Service. At the mid-year commencement exercises of the University of Florida, January 28, 1956, he made this address, somewhat abridged here, upon receiving the honorary doctor of science degree.

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Scarcely a new product brought on the market today can expect to make the grade unless it can be advertised as doing something faster. Detergents wash clothes faster. Household equipment bakes pies, roasts meat, washes dishes, and cools houses—faster. Industrial and business machines accomplish all sorts of tasks—faster. Communication and transportation—all work and get there faster.

Yet all this timesaving has not added even a split-second to our 24-hour day. Instead, the individual is pushed at a faster and faster pace, an endless response to alarm clocks, television, and superpowered automobiles. All this leaves him little opportunity—and less time—to think, to understand himself, his fellow human beings, and the complex environment in which he lives. Yet how much we need this understanding, not only as individual men and women but also as members of families and communities, of our place among all peoples in a shrinking world. Because only through understanding can we make wise decisions as to constructive use of our unprecedented technology. And if ever we needed wise decisions this is the hour.

### Science and Technology

So let us pause to recall a distinction between basic science and technology. The scientific foundations of our understanding of physical laws have been laid slowly by the world's great thinkers through many ages. Modern technology, the prompt and effective application of basic science to practical use, is a product of this era, developed largely since we were born.

Until fairly recent years there was little direct association between the basic scientist and the technologist. G. K. Chesterton, who died in 1936, wrote of this wide gap between the scientific mind and the consequences of the knowledge produced by scientific thought:

"When a man splits a grain of sand," he said, "and the universe is turned upside down in consequence, it is difficult to realize that, to the man who did it, the splitting of the grain is the great affair, and capsizing of the cosmos quite a small one."

There now exists much closer collaboration between the scientist and the technologist, and

even more significant, between both these experts and society. As a result, each scientific discovery, promptly flashed to our network of research institutions, sets off a chain reaction emitting dozens of new discoveries.

Modern industries are ready, willing, and equipped to transform the scientific report or the laboratory demonstration into new or improved products. For example, you are familiar with the rapid development of the frozen-juice concentrate industry in Florida. I never cease to be amazed at the production reports on this industry. One producer said, "We expected much, and got much more."

### What Is Environmental Health?

There exists a close interplay between technology and environmental health. And this interplay becomes closer and more involved as technology moves ahead.

Some of you may ask, "What is environmental health?" This term has come into use in recent years, and no precise definition has been accepted even by the professional groups who use it most frequently. In 1948, the World Health Organization defined human health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." Paraphrasing this statement, we might say that environmental health is a state in which man's environment contributes to his physical, mental, and social well-being and is not merely the absence of environmental hazards to personal health.

We may well accept such a proposition, for man and his environment are indivisible. Ordinarily we think of man as master of his environment, molding it to meet his needs. But it is more realistic to think of the environment and man as molding and changing each other simultaneously.

Environment is a broad term and each facet has its impact on public health. For instance, many people associate alcoholism with the social environment; accidents with the psychological environment. However, let us consider environmental health as it refers to the physical environment—to air, water, food, and shelter. Of these basic essentials, air and water in particular gain importance as our changing

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In earlier years, wastes were piped to the edge of town and given only superficial treatment—often no treatment at all. Factories too were located on the edge of town with stack discharges to the atmosphere. In those days water and air resources were able to absorb community contaminants without undue harmful effects. At worst, factories produced merely local nuisances.

### Changing Character of Wastes

Today, in our metropolitan and industrial complexes, the situation is vastly different. Not only is technology advancing but metropolitan population is increasing—already up 35 percent since 1940. Now a hundred million people live in metropolitan areas of the United States. And for the most part, there is no longer an edge of town. The city blends into the suburban areas, also thickly populated and industrialized; the suburbs into ex-urbia areas, where people use the same water resources and experience the same smog; and vice versa to the next city. In addition, there is the ever-increasing volume of waste. And, most troublesome of all, an increasing complexity in the character of wastes.

Modern cities, with all their diverse activities, discharge thousands of tons of contaminants to air and water every hour. In the chemical complex involving countless new compounds, the resulting actions and reactions, continually occurring in air and water, produce situations extremely difficult to measure and even more difficult to understand. The atomic age introduces an entirely new set of terms, equations, and factors. Radioactive contamination does not follow our set patterns and established formulas of dispersion, dilution, and biochemical actions. Man's ability to control this impact of waste on the physical environment will be a significant factor in future metropolitan growth and development.

By all of this I do not mean to imply that we can quantitate the effects on personal health of contaminants in our physical environment. There is much we have to learn on this score. However, in many areas, these contaminants are causing physical discomfort, economic blight, and agricultural damage. But remem-

ber we are talking about accelerating technology. When we project present trends over the next two decades, the concentrations of contaminants in air and water do have a sobering implication—not only with respect to personal health but even more so to mental and social well-being. We must develop the understanding and remedial practices now to minimize these future difficulties.

What we need most is a better understanding of behavior and effects of contaminants in air and water. To produce this knowledge will require a much broader research effort. Universities and other research institutions should assume leadership in this effort.

On the industrial side, industry officials have an understandable reluctance to accept blame for all the atmospheric and water pollution. Actually, the responsibility is about evenly divided between industrial operations, per se, and public use of the fruits of industrial technology. Air is contaminated by the family car, home fuels, rubbish burning, and the like. Water is contaminated by home laundries, dishwashers, garbage grinders, and so on. From my experience, I am convinced that responsible industry is willing to use its research facilities to adjust its processes in line with a sound control plan. A prerequisite, however, is to know specifically what contaminants from industrial processes are hazardous and at what concentrations. And in our changing situation this is quite a task.

It is obvious that technology has created many problems in environmental health. It has, on the other hand, contributed much to the improvement in our well-being and comfort. It has given us the highest average standard of living the world has ever known.

It has been of direct assistance in providing the United States with remarkably safe public water supplies, by far the best in the world. It has improved food processing and packaging, housing, insect control, and a host of other environmental health measures.

Indirectly, the potential of cheap power from nuclear sources will place in the hands of the engineer a much wider range of possibilities. Reclamation of sea water, talked about for ages, is moving toward practical reality with such developments as the permionic membrane.

technology shapes our Nation more and more into a complex of metropolitan centers.

## Water Resources

Concentrations of people in a technological environment are bound to create all sorts of wastes which pollute and deteriorate the air and water resources. In nature, both air and water have an unusual capacity for absorbing and purifying man-made pollution—up to a point. So long as human activity does not overtax nature, air and water resources remain essentially clean and safe. In our accelerating technology, we do overtax these resources. Corrective practices to preserve a balance acceptable to all interests are not always easy.

Across the Nation, our water resource is becoming a problem of top priority. Available supplies are being increasingly taxed. In many areas, shortages already threaten to halt further expansion. The water problem is one of increasing demands, seasonal shortages, floods, and pollution.

The average urban dweller uses 150 gallons of water per day. Thirty years ago, one person used only 20 gallons per day. There were then few if any laundromats, dishwashers, and air conditioners. The water that goes into production of things you eat and wear and use raises the national per capita requirement to 1,500 gallons per day. By 1975, these water demands will double—expressed on an annual basis, a million gallons per capita for a population of about 200 million.

Industries that need large amounts of water, and that is most of them, will go where it is. And by and large the population will go where industry goes. It is just as simple as that and at the same time just as complicated from the standpoint of future economic, social, and environmental adjustments.

## Water Conservation

The mere availability of water represents only half the picture. As water use increases, pollution increases. What we face, therefore, is a vicious cycle—more water needed, to support more activity, to produce more wastes, to pollute more water. The answer involves a

variety of water conservation measures. Of these, pollution abatement is essential to permit re-use of the water as streams flow from city to city. And remember that 80 million people depend on surface streams for their drinking water.

When I was a boy, three expressions often used were: "cheap as dirt"; "free as water"; and "easy as breathing." The zooming prices of real estate knocked out the first. Water shortage is taking care of the second. And now even the third may have to be qualified. In some areas, the air is not so easy to breathe.

## Air Pollution

Twenty years ago, community air pollution was quite localized and was primarily a problem of smoke abatement. Then in 1948, 5 smoggy days at Donora, Pa., made thousands ill and caused at least 20 deaths. In London, England, in 1952, 7 days of smog implicated air pollution in 4,000 deaths. These episodes should not be dismissed entirely as freak situations.

Less dramatic smog episodes build up from time to time in most of our metropolitan areas. The reality is that the community air supply, like water supply, has limitations. Florida has her water problems, but California leads in the smog problem department. Los Angeles is the best example of a city in our changing technology that is overtaxing its air supply.

In highly developed areas we simply cannot go on forever spewing more and more complex contaminants into the atmosphere without inevitable consequences to public health and community well-being.

We must expect some deterioration of community air resources in this age of ours. The job, as with water, is to limit depreciation in keeping with the entire development of the area.

You may ask, "Why this sudden concern about community wastes reaching air and water?" A popular belief is that it should be simple and easy to purify such wastes before discharge. On the contrary, proper control is both complex and expensive. Water pollution abatement alone will cost a billion dollars a year of somebody's money.

# What Is Happening to Sponsored Training for Nurses?

By DONNA PEARCE, B.S., R.N.

IT IS ESSENTIAL that the professional competency of health workers keep pace with the expanding scope and increasing complexity of modern public health if a high quality of public health practice is to be maintained. Recognizing this principle, the authors of the Social Security Act of 1935 included among its purposes provision for the training of public health personnel. In the early years of the program authorized by this act, designated amounts of money were allotted to States for the specific purpose of developing qualified professional and technical personnel. Later, the State health departments allocated to training whatever amounts from Federal funds they deemed appropriate. In addition, limited funds from State and local appropriations have been used for training purposes. Such training, financially supported in whole or in part from Federal, State, and local health funds, has come to be known as sponsored training.

Nurses, representing the largest single group of professional workers in health departments, have figured prominently as recipients of sponsored training. Of the 6,674 trainees who were sponsored for academic study in public health

during the years 1936 through 1944, 4,032 (60 percent) were nurses (1).

Federal grants-in-aid for health work reached their peak in fiscal year 1951. For grant-in-aid funds administered by the Public Health Service, the peak year was fiscal 1950; after that year, there was a rapid decline each year through fiscal 1954 (2). With this decline in Federal grants, there has been a growing professional concern as to the status of the sponsored training program. Because of this concern, an attempt has been made to find out what is happening to sponsored training for nurses.

For this study, data for an 8-year period, fiscal years 1947 through 1954, were analyzed. Data on the number of nurses who had received sponsored training during each fiscal year 1947 through 1952 had previously been obtained by the Division of State Grants, Public Health Service. For fiscal years 1953 and 1954, comparable data were obtained by the Public Health Service regional consultants through visits and correspondence with State health departments. (In this report, the term "State" includes the District of Columbia, Alaska, Hawaii, Puerto Rico, and the Virgin Islands.)

The data cover all full-time accredited training for periods varying in length from "less than 6 weeks" to 12 months. Accredited training refers to study for which academic credit is granted by a school of public health or by a university or college offering a public health

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*Miss Pearce is assistant chief of Public Health Nursing Services, Division of General Health Services, Public Health Service. She has been with the Public Health Service since 1936.*

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Weather modification, although still in the exploratory stage, has intriguing possibilities. Automation, too, will find increasing application in the environmental health field.

Now to shift gears for a moment. The engineering and technical aspects of pollution control likely will be less difficult in the long run than the related political, economic, and legal considerations. Pollution of air and water more and more influences the patterns of metropolitan growth and land use. The degree of regulatory control, how it is applied, and especially where it is centered, raises important and fundamental questions.

Effects of pollution are seldom limited to one political jurisdiction. Always difficult is the question of financing necessary remedial measures. Even more difficult is the process of ob-

taining agreement among various interests for the best use of environmental resources. There is real need for public awareness and for public understanding. The situation cannot be corrected by merely opening a window or turning a valve.

If the pollution problems of the future are to be met and managed, coordinated city and regional planning must be the basis. This must integrate the social, political, legal, and economic factors with the technical ones. Each State needs to appraise its problems realistically and to develop a framework which will foster a partnership participation by other public and private interests. This will require a degree of effort much better organized and much better understood by the public than are our present practices.

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## Research in Hospital Facilities Field

Grants for research projects to develop new knowledge about hospitals, health services, and health facilities were awarded in February 1956 by the Public Health Service to Yale University, Sinai Hospital, Baltimore, St. Mary's Hospital, Evansville, Ind., Health Insurance Plan of Greater New York, and the American Hospital Association. The grants were awarded, upon recommendation of the Federal Hospital Council, from the recent appropriations under the Hospital Survey and Construction Act for research in the hospital facilities. Eleven grants were also awarded in December 1955.

Yale University will study factors which can be used to achieve maximum functional efficiency in hospital architectural design.

The Sinai Hospital project will demonstrate the extent to which the shortage of professional nurses can be alleviated by employing and training floor managers and general aides for nonprofessional hospital duties.

St. Mary's Hospital will evaluate its new plan to provide more individual care for patients and will demonstrate the reorganization and education necessary to success of the plan.

HIP will analyze available statistical information to determine the influence of a comprehensive medical care insurance program on hospital admissions, patients' length of stay, quality of service given, and hospital costs.

The American Hospital Association study will be a basic analysis of accomplishments over the past decade in planning and building hospitals and health facilities, including the effect of the Hill-Burton program, for the purpose of establishing new scientific guides to planning for future hospitals, nursing homes, rehabilitation centers, and diagnostic and treatment centers.



In interpreting the figures for number of nurses trained, however, variations in the proportion of long-term training periods to short-term periods must be considered. For example, of the 1,082 trainees in Massachusetts, only 16 received training for 7 to 12 months, whereas, of New York's 984 trainees, 426 received training for this length of time. California and North Carolina afford another example. Both of these States fell into the 100-399 category, but California reported that 104 of its 285 trainees received 7 to 12 months' training, whereas North Carolina had only 55 of a total of 296 trainees in this group.

Further analysis of the data for fiscal years 1953 and 1954 shows that 35 States sponsored training for periods of 7 to 12 months in 1953, whereas only 23 sponsored that type of training in 1954. One hundred fifty-eight nurses received training for 7 to 12 months in 1953, and 124, in 1954.

### The Problem

The data presented show that since 1949 there has been a steady decrease in sponsored training for nurses in the United States as a whole, though not necessarily in every State. This decrease is a matter of real concern in view of the need for a continuation and expansion of training. According to the Public Health Service's 1955 census of public health nurses, only 42.2 percent of the nurses employed in State and local official health agencies on Jan-

**Table 2. Number of States and number and percentage of nurses trained according to the range in number of nurses who received sponsored training, fiscal years 1947-54**

Range in number of nurses	Number of States within range	Nurses who received sponsored training	
		Number	Percent
Total-----	53	6, 194	100. 0
400 or more-----	12	2, 030	32. 8
100-399-----	12	2, 557	41. 3
50-99-----	12	938	15. 1
Less than 50-----	27	669	10. 8

<sup>1</sup> Numbers of nurses trained by these States were 984 and 1,032.

**Table 3. Number and percentage of nurses in State and local official health agencies who have had approved public health nursing education, 5-year intervals, 1940-55**

Year	Number nurses employed	Nurses with 1 year or more of public health nursing education		Rate of increase in percentage
		Number	Percent	
1940-----	9, 347	2, 151	23. 0	-----
1945-----	11, 414	3, 395	29. 7	29. 1
1950-----	13, 594	5, 064	37. 2	25. 2
1955-----	14, 152	5, 969	42. 2	13. 4

uary 1 had had 1 year or more of public health nursing education.

Although there has been a decrease in Federal funds for training, these funds are not the only means of providing adequate training for public health nurses. The number of collegiate schools offering educational programs for the preparation of nurses for beginning positions in public health increased from 3 in 1947 to 33 in 1956 (4, 5). A few States are exploring the use of extension courses from universities with approved public health nursing programs as a means of improving the training level of currently employed nurses. Also, two States have obtained funds from their legislatures for the training of a limited number of public health nursing personnel, and still others plan to request such funds. In the 24 States in which universities with approved programs of study in public health nursing are located, nurses may be able to pursue their studies on a part-time basis. Greater efforts along these lines, particularly the use of extension courses, should help to offset the lag in sponsored training. However, still other methods of preparing nurses for public health work may have to be worked out.

The effect of the decline in sponsored training on the qualifications of nurses employed for public health work is not readily apparent, but a few facts that may be indicative can be cited. The percentage of nurses in State and local public health agencies who have had 1 year or more of public health nursing education was greater on January 1, 1955, (42.2 percent) than it was 2 years earlier (40.5 percent). However,

**Table 1. Number and percentage of nurses trained, by length of training period, and number of States participating in sponsored training for nurses, fiscal years 1947-54**

Fiscal year	Nurses trained, by length of training period								Number of States participating
	Total		Less than 6 weeks		6 weeks to 6 months		7 to 12 months		
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Total.....	6, 194	100. 0	1, 367	22. 7	3, 203	53. 3	1, 446	24. 0	53
1947.....	608	100. 0	63	10. 4	411	67. 6	134	22. 0	45
1948.....	<sup>1</sup> 1, 005	<sup>2</sup> 100. 0	351	42. 4	367	44. 4	109	13. 2	45
1949.....	1, 490	100. 0	269	18. 0	943	63. 3	278	18. 7	49
1950.....	1, 185	100. 0	225	19. 0	712	60. 9	248	20. 1	47
1951.....	689	100. 0	160	23. 2	280	40. 7	249	36. 1	47
1952.....	500	100. 0	140	28. 0	214	42. 8	146	29. 2	45
1953.....	411	100. 0	106	25. 8	147	35. 8	158	38. 4	45
1954.....	306	100. 0	53	17. 3	129	42. 1	124	40. 6	41

<sup>1</sup> Length of training not specified for 178 nurses.

<sup>2</sup> 100 percent=827.

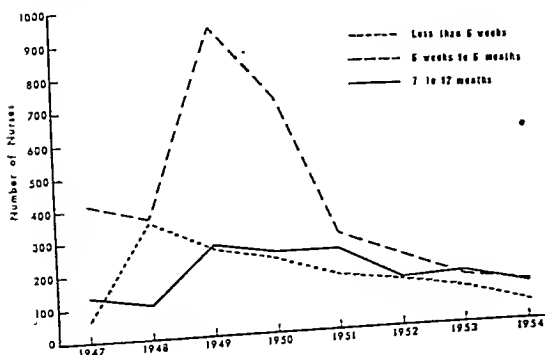
nursing program of study approved by the National League for Nursing.

### The Trends

A total of 6,194 nurses received training during the 8-year period, as shown in table 1. This figure, however, does not necessarily represent the number of individual nurses, since some nurses may have received more than one period of training. For example, California has reported that 29 nurses received stipends for more than one type of accredited training during a 16-year period (3).

The peak year for sponsored training, in terms of both the number of nurses trained

### Number of nurses who received sponsored public health training, by length of training period, 1947-54



and the number of States that sponsored training, was 1949 (see table 1 and chart). Each year since that date, there has been a steady decline in the number of nurses receiving training. From the year 1951 to the year 1954, there was a marked decrease.

The largest percentage (53.3) of the nurses received training for 6 weeks to 6 months. However, the percentage of those sponsored for 7 months to 12 months increased in both the years 1953 and 1954.

Of the 53 States, only 4 failed to sponsor training in 1949. In 1954, this number had grown to 12.

Table 2 shows that there was a widely varying range among the States in the number of nurses trained. Two States trained 32.8 percent of all the nurses, whereas 27 States trained only 10.8 percent. A review of the figures for individual States confirms the expectation that, in general, those with large metropolitan areas employing large numbers of nurses were the ones which trained the greater number of nurses. Massachusetts, with 1,082 trainees, and New York, with 984, were the two States that trained 400 or more nurses. All of the 18 States with a population of less than 1 million are included in the group that trained less than 50 nurses. And of the other 9 States in the less-than-50 group, 6 had populations of 1 to 3 million and 3 had between 3 and 4 million.

# Association of Vitamin B<sub>6</sub> Deficiency With Convulsions in Infants

By E. M. NELSON, Ph.D.

ONE WAY in which the Food and Drug Administration protects the consuming public is by monitoring the recovery from trade channels of any product, food, drug, or device that is found unsafe for use.

In 1953 such a program related to the occurrence of a series of cases of convulsions in infants that had been maintained on an infant food called SMA Liquid Formula (for convenience termed SMA liquid). The Food and Drug Administration's part in correlating the observations on these cases and in concluding that the condition was the result of a deficiency of vitamin B<sub>6</sub>, although discussed at a conference on vitamin B<sub>6</sub> in human nutrition (1) and referred to by May (2), is not reflected in several other published reports of these cases (3-7).

Through its inspectors, the Food and Drug Administration assembled hospital records of a large number of affected infants. After careful study of these records by its medical and scientific staff and consideration of information gained from the manufacturer of the SMA liquid, particularly with respect to changes in composition of the product, it was possible to recognize interrelationships not apparent to the pediatricians who attended the individual cases.

Although at the time a confidential state-

ment containing this information was submitted to the National Institutes of Health, the Food and Nutrition Board, and the Council on Foods and Nutrition of the American Medical Association, it may be well to set forth, for a wider audience, the sequence of events that led to a recognition of the relation of vitamin B<sub>6</sub> to the infant convulsions. It is hoped that this will encourage prompt reporting of any unexplained disease condition that may be related to ingestion of a food or use of a drug, thereby enabling the Food and Drug Administration to take remedial steps at the earliest possible stage to safeguard the public.

Early in December 1952, the Food and Drug Administration received a letter from an Arkansas resident, a trained nurse, whose 3-month-old infant had developed convulsive seizures. She gave a complete and informative case history of her child, who had been fed SMA liquid from birth. The attending pediatrician apparently suspected the condition was associated with SMA liquid because he immediately changed the formula to evaporated milk and Karo syrup. Complete recovery from the convulsions resulted from this change. The mother then learned of eight similar cases in her community, all associated with the use of SMA liquid. All of the infants recovered from convulsions following a change of formula.

A short time later the director of the Arkansas Division of Food and Drug Control discussed the problem with our St. Louis district office, asking if we had received consumer com-

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a comparison of the figures for 5-year intervals since 1940, in table 3, shows a definite deceleration in the rate of increase in the percentage of nurses with 1 year or more of public health nursing education.

### Summary and Conclusions

Data for an 8-year period, fiscal years 1947 through 1954, show a steady decrease in the number of nurses receiving sponsored full-time accredited training since 1949. The decrease is more marked for the years 1951 through 1954 than for 1949 and 1950. Although the numbers of nurses trained were smaller in 1953 and 1954 than in previous years, the percentage of long-term (7 to 12 months) training periods increased in both years.

The number of States not sponsoring any training for nurses has increased since 1949. In 1949, 4 States did not sponsor training, and in 1954, 12 did not.

As might be expected, there was a wide variation among the States in the number of nurses trained. Twenty-seven States each sponsored less than 50 trainees. Two States each sponsored 900 or more.

The States are making some effort to make up the loss of Federal funds through State appropriations and through use of extension

courses from universities. The increase in the number of collegiate basic nursing schools approved for the preparation of nurses for beginning positions in public health nursing is another encouraging sign.

However, the decided slowing up in the rate of increase in the percentage of qualified nurses employed by State and local official agencies indicates that greater efforts will have to be made to offset the lag in sponsored training. In addition, ways must be found to extend and intensify training efforts at a rate consistent with the need to overcome present deficiencies and to meet future demands.

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## OVR Appoints Advisers on Training Policy

The Office of Vocational Rehabilitation has appointed an Advisory Committee on Training Policy to help solve the nationwide shortage of persons trained to work with the handicapped.

The training program was established by Public Law 565, 83d Congress, in 1954 to increase the available supply of professional personnel whose skills are required in the vocational rehabilitation of disabled persons.

In the initial phases of the program, Federal grants have gone to educational institutions to help meet part of the cost of establishing or expanding curriculums in the shortage fields. Grants also have been made to individuals in such areas as social work, occupational therapy, psychology, nursing, rehabilitation center direction, rehabilitation counseling, medicine, and work with the visually and aurally handicapped.

or requirements of the infants for this vitamin? And second, why should the deficiency occur with SMA liquid and not with SMA powder which had the same composition?

### The Solution

The replacement of coconut oil by palm oil in the SMA products was based on the demonstration that this change resulted in stools that, in many respects, more nearly simulated the stools of breastfed infants. A substantial change was also observed in the intestinal flora, with a marked increase in numbers of *Lactobacillus bifidus*. Obviously, either the population of organisms requiring B<sub>6</sub> may be increased or the population of organisms that produce vitamin B<sub>6</sub> reduced as a result of this change in the fatty constituents of the product. Three studies reported in 1938 show an important relationship between vitamin B<sub>6</sub> requirement and the fat in the diet with particular reference to the nature of the unsaturated fatty acids present (9). Witten and Holman (10) have presented evidence that in the rat there is a need for pyridoxine for the synthesis of the more highly unsaturated fatty acids.

Experiments in our laboratory had indicated that although pyridoxine hydrochloride is stable when autoclaved at 15 pounds pressure at a pH of 7, the vitamin B<sub>6</sub> in natural products is reduced substantially by such heat treatment. Pyridoxal and pyridoxamine, forms of vitamin B<sub>6</sub> that occur in food, are types of compounds known to react, upon heating, with amino acids and sugars to form a complex which the animal cannot fully use (11, 12). SMA liquid is subjected to a process of heat sterilization, but SMA powder is not. Therefore, the liquid product may be expected to be lower in vitamin B<sub>6</sub> content than the powder.

In examining SMA liquid for vitamin B<sub>6</sub> content, we were unable to obtain satisfactory results because the chemical method in use for the examination of pharmaceutical products was not applicable to milk products. Attempts to produce convulsions or other evidence of vitamin B<sub>6</sub> deficiency in rats were unsuccessful since the low protein and high lactose content of the product are not adapted to the nutritional requirements of the rat.

More recent analytical evidence has clearly demonstrated that SMA liquid contained a lower level of vitamin B<sub>6</sub> than similar liquid infant formulas, and less than the amount found in the SMA powder. This confirmed our suspicion based upon knowledge of the composition and effect of processing.

A careful resurvey of the case records of the infants affected showed that in the few instances vitamin supplements had been used none of them contained vitamin B<sub>6</sub>.

The general causes of convulsions in infants and the plausibility of the explanation offered in this instance were discussed with Dr. Irvin Kerlan and Dr. Leo Parmer of the FDA Division of Medicine. This discussion led to the referral of some of the case histories to Dr. L. Emmet Holt since he and his associates (13) had reported studies of vitamin B<sub>6</sub> deficiency in infants. After reviewing these cases, Dr. Holt expressed the view that the symptoms described resembled those he had observed. The Division of Medicine then urged pediatricians to test clinically the effect of pyridoxine hydrochloride in infants showing SMA convulsions without changing the feeding formula.

Early in May investigations of hospital records revealed the occurrence of more than 50 cases of SMA convulsions in the vicinity of Lancaster, Pa. Additional occurrences were reported at Walter Reed Hospital in Washington, D. C., brought in from widely separated Army installations. Also, called to our attention were reports of three new cases in areas where it was thought the offending product had been replaced by a new formula. A more effective and complete recall of codes under suspicion began on May 15. Two weeks later a nationwide check by the Food and Drug Administration to determine the thoroughness of this recall indicated that it was reasonably complete, although there were instances in which confusion arose in identifying the codes and in which there was some uncertainty about the amounts in the hands of individual purchasers. More than a million cans of the suspect product were removed from the market.

On May 29 the Food and Drug Administration was advised by telephone that Dr. Charles D. May of the University of Iowa had treated an infant showing SMA convulsions by intra-

plaints about SMA liquid. The manufacturing firm, we learned, was aware that the product was associated with infant convulsions. Of the 12 cases reported to the firm the majority had occurred in Arkansas and northern Texas, and the firm attributed the condition to a change in mineral content of water used to dilute the product for feeding. There had been a severe drought in the Arkansas-Texas area, and the attention of the firm was focused on a possible mineral imbalance that might cause the tetany-like syndrome.

### Accumulative Evidence

In investigations during January and February of 1953, the Food and Drug Administration developed the following facts:

1. More than 50 cases of so-called SMA convulsions had occurred.

2. At this stage the majority of cases had been found in the Arkansas-Texas area.

3. Invariably the sick infants had been fed SMA liquid with no vitamin supplements. Similar symptoms and physical signs were noted in the affected infants. These included hyperirritability (particularly sensitivity to noise), diarrhea, and vomiting (frequently projectile), followed by convulsive seizures lasting from one-half to 5 minutes, and recurring from once or twice daily to as many as 11 times daily. Rectal temperatures ranged from 99° to 101° F.

4. The convulsions appeared in infants ranging in age from a few weeks to nearly 1 year.

5. The formula for SMA, both powder and liquid, had been changed some time prior to January 1952 by replacing the coconut oil in the fat by palm oil.

6. All cases of convulsions were traced to the new SMA liquid formula by codes containing the letters "H" or "I".

7. In every case reported there was relief from the convulsions when the food formula was changed.

8. No cases of convulsions were reported from the use of powdered SMA, which had the same basic composition as the liquid.

9. Sedatives relieved the convulsions some, but no other medication was effective.

10. There was no clue as to the causative agent

from chemical examinations of blood and urine or from clinical tests or clinical trials.

11. Samples of the product were found to be sterile.

12. Chemical examination of the product revealed nothing unusual.

13. Many of the infants whose case records came to our attention had been under the care of pediatricians, and thorough studies had not established the etiology of the convulsions.

14. Records of such cases were not found in those larger cities where hospitals were surveyed by food and drug inspectors.

Late in March 1953, in the Food and Drug Administration, the files on this subject were referred to the Division of Nutrition for study. It was noted that the irritability and convulsive seizures described in the case records resembled the symptoms in rats from mothers on a vitamin B<sub>6</sub> deficient diet that had been observed in the division's laboratories (8). The rapidity of the infants' response to a change in the formula was also characteristic of the animals' recovery from symptoms of deficiency with a change to an adequate diet. Such a prompt response is not usually observed in the treatment of a toxic condition.

The composition of SMA liquid was also a basis for suspecting nutritional deficiency. The product was made from skimmed milk to which fats, lactose, vitamins A, D, C, B<sub>1</sub>, B<sub>2</sub>, and niacin, and potassium carbonate and ferrous sulfate were added. The reduced proportion of milk solids was supposed to provide a level of protein simulating that of mother's milk, although with such modification the amounts of water-soluble nutrients of milk, including vitamin B<sub>6</sub>, were similarly reduced.

Dr. O. L. Kline of the Division of Nutrition was the first to associate the symptoms observed with vitamin B<sub>6</sub> deficiency and to offer an explanation that was in harmony with all of the facts developed. That was in March 1953, more than 6 months after the first cases occurred and after 50 or 60 cases had been treated by physicians in many areas of the country. But if vitamin B<sub>6</sub> deficiency was the true cause of convulsions in the infants, two questions had to be answered: First, in what manner could the substitution of palm oil for coconut oil influence the vitamin B<sub>6</sub> content of the product

# PHS films

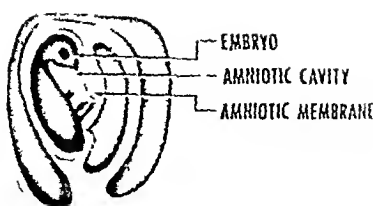
## Embryonated Egg Techniques for Virus Studies

35 mm. Filmstrip, black and white, sound, 11 minutes, 59 frames, 1955.

Audience: Trainees in virology techniques, virus laboratory directors, and technicians.

Available: Loan—Public Health Service Communicable Disease Center, 50 7th St. NE., Atlanta 23, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

Serving as an introduction to embryonated egg methods for isolating viruses in virus laboratories, public



## Anatomy of embryonated egg.

Applications of these processes to the yolk sac, allantoic fluid, chorio-allantoic membrane, and amniotic cavity are pictured. Both the "window" and the direct procedure for inoculating the amniotic cavity are shown.



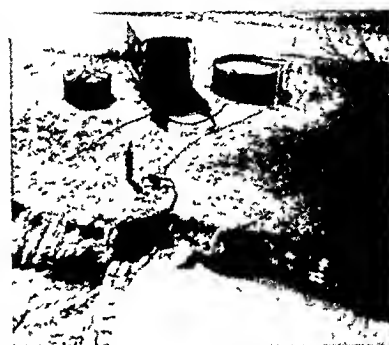
## Inoculation of chorio-allantoic membrane.

health laboratories, and medical schools, this filmstrip illustrates several egg inoculating and harvesting techniques.



## Harvesting allantoic fluid.

and emphasizes the distinct role of each in combating the dangers to public health arising from an actual flood situation.



## Mobile water purification unit for disaster relief.

## Disaster Aid—Public Health Aspects

16 mm. Film, black and white, sound, 11 minutes, 1955.

Audience: Health officers, sanitarians, and sanitary engineers on emergency sanitation.

Available: Loan—Public Health Service, Communicable Disease Center, 50 7th St. NE., Atlanta 23, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

Designed to show the methods used to solve health problems created by natural disasters, this film de-



## Emergency immunization carried out as a flood relief measure.

picts work carried out by the Communicable Disease Center and other disaster relief agencies during flood conditions.

It documents the efforts of local, State, and Federal health agencies

## A Plant Health Program

35 mm. Filmstrip, sound, black and white. 14 minutes, 54 frames. 1955.

Audience: Health department personnel, physicians, nurses, management, and labor.

Available: Loan—State health departments; Public Health Service regional offices; and Occupational Health Program, Public Health Service, U. S. Department of Health, Education, and Welfare, Washington 25, D. C. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

Interest in employee health programs is greater than ever before, and such programs are being developed in increasing numbers.

Management, labor, and the health professions are all affected, directly or indirectly, by this development. Financed by management, employee health services are provided at, or through, the place of work. More and more, they are being recognized as an indispensable means of keeping the worker healthy and on the job.

This filmstrip tells the story behind employee health services. By taking the viewer to a printing plant in Louisville, Ky., to watch an employee health program in operation, it helps to answer such questions as: Why are employee health programs being established? What services do they provide? What do they accomplish?

muscular administration of pyridoxine hydrochloride, while maintaining the infant on the SMA liquid. The infant recovered completely from convulsions. This report was confirmed by letter from Dr. May a few days later. Confirming reports from other investigators followed within a short time. With confirmation of the relationship of SMA convulsions and vitamin B<sub>6</sub> intake in infants, the manufacturer added pyridoxine hydrochloride to the product. It appears that several weeks were required for complete replacement of old stocks, since we learned of a few cases of the illness as late as September 1953, even after the palm oil was eliminated and the old formula reestablished (14). In the succeeding 2 years no additional occurrences of convulsions were reported.

It is significant that the majority of cases of infant convulsions occurred in rural areas rather than in the larger cities where the large proportion of infants are under the care of pediatricians. The prevailing practice by many pediatricians of supplementing liquid formulas with solid foods and vitamin preparations at an early age may not be followed in some rural areas. It is significant, also, that more than a hundred cases of vitamin B<sub>6</sub> deficiency occurred in this country before the condition was recognized as a deficiency disease.

With constant improvement in food processing, acceptable methods are needed for determining the nutritional adequacy of infant foods. For products in which the lactose is increased to simulate mother's milk, the classical biological test with the rat is impracticable because of intolerance to lactose.

The Food and Drug Administration is in a particularly favorable position to assist public health officials and the medical profession in bringing under control disease outbreaks or unusual reactions that are related in any way to the use of foods or drugs. With its investigational authority and its experienced investigational staff, facts may be collected without delay for review by the medical and scientific staff. It would be helpful if there were prompt reporting to the Food and Drug Administration of occurrences of unexplained disease con-

ditions or unusual reactions, particularly where association with the use of a particular food or drug is suspected. In such reports it is very helpful to have the complete case history and the codes or batch marks of the suspected product.

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Beneath the kitchen sink may be a handy place for storage, but it's also within reach of busy little hands. "Protect Your Family Against Poisoning" reminds us to keep all drugs, poisons, and other household chemicals out of reach of children and away from foods . . . to safeguard brightly colored capsules and tablets that look like candy . . . to warn youngsters not to eat or drink any drugs and chemicals they find.

*Turn to next page for text of leaflet.*



# Protect Your Family Against Poisoning

By IRVIN KERLAN, M.D.

MORBIDITY and mortality statistics reveal a high frequency of poisoning from accidental ingestion and other types of misuse of drugs and household chemicals by young children. Parents need to know more about how to protect their families from such accidents.

The prevention of accidental poisoning in the home has been an active undertaking of the American Academy of Pediatrics Committee on Accident Prevention, the American Medical Association Committee on Toxicology, and the American Public Health Association Subcommittee on Chemical Poisons.

Government representatives of the Public Health Service, the Food and Drug Administration, and the Agricultural Research Service of the United States Department of Agriculture are members of the committees. The National Safety Council, the American Red Cross, pharmaceutical organizations, drug manufacturers, medical societies, health departments, insurance companies, and others concerned with the safe distribution of drugs are also engaged in averting misuse of drugs and household

chemicals through label warnings, directions, special packaging, and educational programs.

Although gains are to be expected through special educational efforts and informative labeling of drugs and economic and caustic poisons, further progress can be made through a leaflet which may be prominently placed in the bathroom or kitchen where it will serve to remind the family how to safeguard the daily handling and storing of the many potentially harmful substances so prevalent in the home.

This thought led to the publication of "Protect Your Family Against Poisoning" as a pilot project of the Food and Drug Administration to encourage use of the pamphlet by health groups, food and drug manufacturers and distributors, leaders in safety education, and publishers, in reaching persons in the home. The Administration will gladly grant permission for reprinting the circular.

Almost all 10,000 copies of the circular printed in November 1955 have been distributed. The leaflet has received many commendations for its practical usefulness. So far, it has been reproduced or cited in a number of health journals and pharmaceutical publications. It has been presented on radio and television shows and mentioned in speeches by government officials. The National Safety Council has reprinted the pamphlet and so have State, county, and city health departments.

Through the reprinting by one pharmaceutical wholesaler in its safety booklet, 1,250,000 copies will become available. An estimated half million copies have already been printed by *FDC Reports* and *FDC Drug Letter* for distribution by retail druggists to their customers.

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*Dr. Kerlan, the author of "Protect Your Family Against Poisoning," is associate medical director, Food and Drug Administration, Department of Health, Education, and Welfare. The photographs on the opposite page are provided through the courtesy of Dr. Charles M. Cameron, Jr., associate professor of public health administration, University of North Carolina School of Public Health. The pictures are of his own children.*

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*Local health departments in California are increasing their services and activities to meet the needs of the chronically ill in their communities.*

## California's Chronic Disease Activities

By LESTER BRESLOW, M.D., M.P.H., NANCY OTT, M.P.H., and VIVIAN CHIN, B.S.

IN 1950, the California Conference of Local Health Officers adopted in principle a guide, Chronic Disease Control Program in Local Health Departments. This guide defined some chronic disease control activities which local health departments might incorporate into their regular programs. Suggested activities in control of cancer, heart disease, diabetes, obesity, crippling conditions, and chronic alcoholism were listed. For each of these categories, items were suggested which "can be incorporated into most current programs," and which "could be added to many current programs."

By 1953, interest in this new area of public health endeavor had developed to the point that the conference requested the California State Department of Public Health to survey current local health department activities in the field. The bureau of chronic diseases undertook this task during the first 6 months of 1954, in cooperation with the department's consultants in the several public health specialties—health education, laboratories, nutrition, public health nursing, records and statistics, and social serv-

ice—which most closely pertain to chronic disease control. Advice and assistance were also obtained from a committee of the conference of local health officers, and from the division of local health services in the State health department.

A form was designed to obtain information on (a) general activities (special studies and projects in the chronic disease field, liaison with voluntary health agencies, participation in development of community services for chronic illness); (b) case-finding services for chronic disease; and (c) activities in the six special public health fields mentioned above. These three categories included 45 separate items.

The information was obtained in two ways. In some instances, individual consultants of the State health department gathered data from the local health departments in the course of their regular visits. In about half the departments, the data were obtained in a group conference, in which the consultants met with the local health officer and his staff, at the request of the health officer. In each case, a physician from the State health department recorded the information in the first two categories—general activities and case-finding services. A departmentwide meeting of the local health department was devoted to this survey in several counties.

The survey covered 49 of California's 52 full-time health departments. For local reasons, such as temporary absence of the health officer, the information was not obtained for three departments. A summary of the data

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*Dr. Breslow is chief, Miss Ott is health education consultant, and Miss Chin is assistant public health analyst, bureau of chronic diseases, California State Department of Public Health, Berkeley, Calif. Dr. Breslow is also chairman, Subcommittee on Chronic Disease and Rehabilitation, Committee on Administrative Practice, American Public Health Association.*

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## Text of Pamphlet on Poisoning

*Keep this where you will see it often.*

- In the event of an accident, immediately call a physician or the nearest hospital.

- Keep all drugs, poisons, and other household chemicals out of the reach of children and away from food.

- Lock up all dangerous substances.

- Do not store poisonous or inflammable substances (kerosene, gasoline, rat poisons, and so on) in food or beverage containers.

- Read all labels and carefully follow "caution" statements. Even if a chemical is not labeled "poison," incorrect use may be dangerous.

- Do not eat or serve foods which smell or look abnormal and remember that they may poison household and farm animals.

- Be sure all poisons are clearly marked. This can be done by sealing with adhesive tape or using a special marker.

- When you throw away drugs or hazardous materials be sure the contents cannot be reached by children or pets.

- Warn small children not to eat or drink drugs, chemicals, plants, or berries they find, without your permission. Insist on this.

- Use cleaning fluids with adequate ventilation only, and avoid breathing vapors.

- Protect your skin and eyes when using insect poisons, weed killers, solvents, and cleaning agents. Be sure to wash thoroughly after use of such things and promptly remove contaminated clothing.

- Do not allow food or food utensils to become contaminated when using insect sprays, aerosol mists, rat poisons, weed killers, or cleaning agents.

- Do not take or give medicine in the dark. Be sure you can clearly read the label on the container.

- When measuring drugs give it your full attention. Give infants and young children drugs only as directed by your physician.

- Before measuring liquid medicine always shake the bottle thoroughly.

- Safeguard tablets which are coated, flavored or colored, since children eat them like candy.

- Do not take medicine from an unlabeled bottle—transparent tape over the label will protect it.

- Date all drug supplies when you buy them.

- Weed out the left-overs regularly from your medicine chest—especially any prescription drug that your physician ordered for a particular illness.

- Use a prescription drug only for the patient for whom the physician ordered it.

- Read all directions and caution statements on the drug label each time you plan to use it.

a letter indicating the desirability of seeing a physician.

Six departments have carried on chronic disease case finding by means of multiphasic screening programs, ordinarily in cooperation with voluntary health organizations and county medical associations. Several others have engaged in some organized case-finding services for cancer, heart disease, diabetes, or other chronic diseases as separate conditions.

### Records and Statistics

Only about one-third of California's local health departments include statistical personnel on the staff. However, most departments do prepare chronic disease mortality data for use in annual reports, monthly bulletins, and talks by physicians and others. Morbidity data concerning chronic diseases are scanty. In a few instances, departments indicated that they have prepared reports concerning nursing, case finding, or other services for chronic disease. Approximately 40 departments reported that they assist hospitals and other agencies in the follow-up of cancer patients or other chronically ill patients at least through search of death certificates and other health department records. Some also provide occasional statistical services to other agencies studying chronic disease in the community.

### Public Health Nursing Service

Reports from the local departments indicate that in practically all local health jurisdictions in California nursing service has become a "generalized service," with attention to the entire household, not just to the sick child or the tuberculosis suspect. The public health nurse in her home visits is usually aware of possible chronic disease in family members and offers help in making use of available screening services and other community resources. Often she encourages regular physical examinations and makes suggestions on home safety.

Public health nurses in local health department clinics are alert to the possibility of chronic disease, noting obesity and other signs which may indicate need for attention. In the

schools, the nurses often orient teachers to the possible significance of overweight and provide educational materials for school personnel and students on cancer, heart disease, diabetes, and other chronic diseases. When, in community contacts, they are asked for suggestions for meetings of various groups, many public health nurses arrange for use of educational films and other resources on chronic disease supplied by the local health department.

Two local health departments reported that they give bedside care upon request, with no restrictions. Seven other departments noted that they provide some degree of bedside nursing care for the chronically ill, beyond demonstration teaching.

Answers to questions about followup of patients showed that, in general, public health nurses were giving more attention to poliomyelitis patients than to patients who have rheumatic fever and other chronic diseases.

The majority of public health nurses in the State now have access to and utilize other specialties important to adequate care of patients with chronic illness, for example, social work, nutrition, physical and occupational therapy, rehabilitation, and psychiatry.

### Social Service

Nine of the surveyed health departments include social workers as members of the staff. In addition, most departments state that they utilize social service consultation from other agencies, both those in the community and from the State health department. Wide variation was reported in resources for referral. The urban areas usually have access to many public and private agencies, and the less populated areas sometimes have only the county welfare department as a resource.

According to reports received, every health department takes some responsibility for helping chronically ill persons obtain financial, medical, rehabilitation, and casework assistance. During a multiphasic survey in one of these local health departments, the medical social worker met several times with a group of obese patients to help them discuss some of their problems in staying on diets. The social workers

supplied by the 49 departments for each major section of the questionnaire follows.

### General Activities

Nineteen local health departments reported that they had carried out special projects in the chronic disease field during the past 5 years. These included multiphasic screening, special cancer studies, bedside nursing care for the chronically ill, education on health aspects of aging, and studies of the need for chronic disease hospitals, sheltered workshops, and other facilities.

Most departments maintain close liaison with the county chapters of the American Heart Association, American Cancer Society, and other voluntary health organizations active in the field of chronic disease. Usually the health officer, the director of public health nursing, the health educator, or other members of the staff serve on boards or committees of these organizations, thus aiding in the planning and development of a communitywide attack on chronic illness problems.

About two-thirds of the 49 departments indicated that they have taken leadership or joined with other organizations in promoting community services important in the control of chronic disease—for example, rehabilitation services, casework and housekeeping services, resources for the treatment of alcoholism, and tumor clinics. The health officer in one county took the leadership in getting a new wing for chronically ill patients at the county hospital, and he meets regularly with the county hospital staff to consider problems of the chronically ill.

Most departments maintain in some form current information on services for the chronically ill available in the community, for use of department staff members. As yet, however, little has been done in the way of organized staff education (in local departments) on chronic disease control, or in staff participation in planning such education.

### Case-Finding Services

California's local health departments each year provide some type of clinical services to

several hundred thousand persons, including both children and adults. Many of these departments reported that they were taking additional advantage of these services for the detection of chronic disease, thus getting patients under care early and minimizing the likelihood of disability or premature death. Opportunities for such case finding have been recognized in conjunction with the usual venereal disease, maternity, child health, and preemployment clinics and as an adjunct to such established activities as tuberculosis case finding. A few departments have also carried on special chronic disease case finding.

The survey showed that 16 departments have included, or are including as part of their clinical services, one or more tests for the detection of such chronic conditions as diabetes, cancer, and heart disease. Also, in the course of their regular services, they are observing and counseling patients regarding obesity. One local department reported blood sugar screening on all venereal disease patients. Approximately 20 departments conduct maternity clinics and routinely run urine sugar tests on patients; thus, they have an opportunity in diabetes detection. Another department does a cytology test for cancer on its clinic patients and is also carrying on a cooperative program of such screening with the county hospital. Arrangements have been made in this program to include women attending obstetrics and gynecology clinics and those entering the county rehabilitation center, as well as health department staff members who wish to participate. When abnormalities are found, the patients are referred to their own physicians or to the county hospital, as appropriate, for followup diagnostic examinations and care.

According to reports received, over two-thirds of the local departments conduct some chest X-ray screening service. Although this is primarily for tuberculosis, case finding for lung cancer and heart disease is also done. In many instances, lung cancer suspects are called back for secondary films and are followed as intensively as tuberculosis suspects. Heart disease suspected from chest X-ray films generally receives less attention; only about one-third of the departments call such patients back for secondary films. Usually the patients receive only

partment staff in one county works regularly with the Aging Committee of the County Welfare Council.

### Laboratory Services

For the most part, laboratory services are available only to patients coming to health department clinics for tuberculosis, rheumatic fever, or prenatal care, and for civil service employment examinations and the like. These services generally include urinalysis, blood sugar determination, hemoglobin determination, and blood counts. A few departments provide only certain clinical laboratory services, which are usually furnished by department contract with an outside clinical laboratory.

Seven health department laboratories reported that they provide a variety of clinical procedures, such as antistreptolysin titers and sedimentation rates. In 3 others, these services are provided by the department jointly with the county hospital; in 8, the laboratory work is done entirely by the county hospital, private clinical laboratories, or a combination of both.

One interesting development is a cytology screening service for cervical cancer which is operated by a county health department laboratory primarily for patients in county hospital clinics. Two other departments provide blood sugar screening for detection of diabetes. Some of the larger departments which have responsibility for rheumatic fever services utilize electrocardiograms. In a few instances, these are used also in preemployment examinations for civil service personnel. Several of the local health department laboratories have been involved in multiphasic screening programs.

Ten departments reported that they have been consulting with county medical societies and other professional groups to develop technical mechanisms for chronic disease detection.

### Summary

A majority of the local health departments in California which took part in a survey of current activities in 1954 stated that they had done one or more of the following: carried out special projects in chronic disease control; maintained close liaison with voluntary organi-

zations active in this field; and either taken leadership or joined with other groups in promoting community services for the chronically ill. Although there had not been much special chronic disease case-finding effort at the time of the survey, local health departments were beginning to take advantage of their regular clinics for this purpose. Public health laboratory work is also being redirected to cope with growing problems in chronic disease. Forty of the forty-nine departments indicated that their records and statistics personnel assist hospitals and other agencies in followup of cancer or other chronically ill patients through search of death certificates and other health department records.

In the past, health department nurses have generally limited their activity in the field of bedside care to demonstration services. The intent has been to train a responsible member of the family to continue it. Recently, several factors appear to be forcing a change in this policy: smaller families and household separation of the generations; the need for close supervision in certain forms of therapy for chronic disease, such as the administration of drugs; and increasing public pressure for home care of long-term illness as an alternative to institutional care. Of all direct services to chronically ill patients, bedside nursing care now appears to be attracting the greatest attention on the part of public health administrators. Administrators of public health nursing services are actively considering the extent to which public health nurses should provide bedside nursing care in the home.

In the rural areas of the State particularly, the full range of social services needed for the care of chronic illness was often not available. However, in addition to joint work with voluntary organizations, there appears to be a trend toward closer collaboration among health departments, county hospitals, and welfare departments in meeting the needs of patients with chronic disease.

In recent years, nutritionists have given particular attention to group teaching for patients with diabetes or obesity. It also appears that nutrition information is increasingly being incorporated into the regular educational services

in another department offered individual help to chest clinic patients who were potential cardiac or cancer patients to assist them in seeking care elsewhere and in making use of resources available to them. Only a few departments provide social services directly to patients; generally, health department staff members refer patients with such problems to other community resources. Although each health department did not specifically indicate its procedure, nine noted that they follow up either with the patient or the agency to determine whether the patient received the service for which he was referred.

### Nutrition Service

Only 6 of the 49 local health departments reported nutritionists as members of the staff, but most departments avail themselves of nutrition consultation from the State health department and from other local agencies.

Local health department staff members (usually the nutritionist or public health nurse) are sometimes called upon to interpret special diets prescribed by physicians for patients with diabetes, cardiovascular disease, and obesity. They also appear to be aware of the diet policies of other public agencies, such as welfare departments and county hospitals.

Only one health department reported having sponsored a course on nutrition in diabetes. However, seven departments stated that their *public health nurses are working with groups of school children on weight control*. In four agencies, nutritionists or public health nurses have been serving as group leaders with groups of obese adults. In five instances, weight-control groups have started among the staff members of the health departments themselves. Weight-control education on a group basis has progressed almost exclusively in urban areas.

Several departments have arranged for nutrition consultation to institutions caring for the chronically ill, either by local staff members or from the State health department.

In one department, the nutrition consultant conducted an education program for the nursing staff on the nutritional aspects of chronic disease, covering problems in diabetes, rheumatic fever, adult health, and obesity. One

interesting method of staff education has been the preparation of low-calorie luncheons by the nurses for the whole department, with supervision by the staff nutritionist.

### Health Education

In 22 of the surveyed agencies, health educators are members of the staff.

Practically all health departments provide and distribute some chronic disease educational materials to community agencies, schools and colleges, clinics, and other appropriate groups. Several have participated in exhibits on chronic disease, for example, at county fairs. Some health departments indicated that they provide assistance to schools and colleges in planning a curriculum concerned with chronic disease.

About half of the local health departments report staff participation in providing for the community some type of group learning experiences related to chronic disease. Eleven departments have given assistance with programs on chronic disease to other agencies and community groups. For example, one department aided the county medical society with a special diabetes program designed to reach men's groups. Another worked with the local chapter of the American Cancer Society in developing a group discussion program for agricultural workers. A third assisted the county branch of the American Heart Association in *putting on a symposium on heart disease*. In another county, the health department provided assistance to the adult education division of the county schools and other groups in developing and carrying out a course on problems of aging.

In addition to the liaison that most departments maintain with county chapters of the American Cancer Society, one department reported that it carries out regular joint planning of educational activities with the local society. These include inservice education for public health nurses serving county schools, in the use of approved cancer education kits as teacher resources. Another department reports having discussed cancer and some other chronic diseases at joint staff meetings with the county schools curriculum committee. The health de-



*One of several integrated studies of physiological fluoride effects, this series of tests explored the toxic effects in animals as a basis for studies in man. The tests demonstrated that an appreciable amount of fluoride is necessary to produce deleterious effects.*

## Acute and Subacute Toxicity Studies of Sodium Fluoride in Animals

By NICHOLAS C. LEONE, M.D., ERVING F. GEEVER, M.D., and NEIL C. MORAN, M.D.

CURRENT knowledge of the dosage of fluoride required to produce toxic effects in man is derived principally from suicidal or accidental poisonings (1-5). Since the exact doses ingested and absorbed are unknown, interpretation of the relationship between clinicopathological findings and dosage is difficult. The lack of reliable methods for determining minute blood fluoride levels adds to the difficulty of evaluation.

With the more widespread use of fluorides in industry, in agriculture, and in the home, there is need for additional evaluation of acute fluoride effects. Whereas some information is available concerning chronic toxicity, there is

less concerning the acute toxic effects in man and animals.

The present study was undertaken to obtain data on the acute and subacute physiological and pathological effects of intravenously and orally administered sodium fluoride in animals. It was also undertaken to determine the safe limits of intravenous administration as an aid to the study of fluoride excretion in man.

### Methods

Two types of animals, dogs and mice, were used in the experiments.

The 27 dogs tested were unanesthetized mongrels of both sexes, weighing from 7 to 10 kilograms. For convenience the dogs were separated into five groups as follows:

*Group 1.* Five dogs were used for the determination of the acute lethal dose by continuous infusion to the point of death, using a calibrated infusion pump.

*Group 2.* Nine animals were given sodium fluoride in selected fractions of the acute lethal dose (with the same technique and infusion rate as in group 1) and observed for varying periods.

*Group 3.* Two dogs were given daily intravenous injections of sodium fluoride for 23 days.

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*The authors are all with the National Institutes of Health, Public Health Service. Dr. Leone is chief of Medical Investigations and Dr. Geever is pathology consultant with the National Institute of Dental Research. Dr. Moran is head of the Pharmacodynamics Section of the Laboratory of Chemical Pharmacology, National Heart Institute.*

*Technical assistance was given by William M. Butler, Jr., M.S., and James S. Watts, B.S., of the Laboratory of Chemical Pharmacology, and Patricia B. Geiser, M.S., Public Health Service Nurse Officer with the National Institute of Dental Research.*

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of health departments in California, with use being made of films, printed materials, and demonstrations.

This survey, in addition to bringing in the information, served an immediate educational function. It focused the attention of hundreds of public health workers throughout the State on things that were being done and things that could be done for chronic disease control.

The information compiled and presented in this report is that furnished to the consultants of the California State Department of Public

Health by the health officers and members of their staffs. It indicates, from an overall viewpoint, that health department services and activities for chronic disease control in California, while not extensive, are increasing. Although no one department is carrying out a comprehensive program for the prevention and control of chronic disease, and in some agencies little or no attention is being given to this field, the trend seems clear—a gradual reorientation of public health services to meet the needs of the chronically ill.

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## *An Important Date*



Each month your health department and many hospitals, laboratories, schools, clinics, and homes receive a copy of PUBLIC HEALTH REPORTS, mailed to arrive on the 20th, or even earlier, depending upon geographic location of the subscriber.

Its pages carry timely research reports, analyses of current trends, new methods, concepts, and ideas, and topical reviews for the busy scientist, teacher, or public health worker. Capsule coverage of important public health meetings, like those of the American Public Health Association, help the PHR reader.

You can have your personal copy promptly. Use the subscription blank on the inside back cover. Let the 20th of each month be an important date for you, too.

### *Scheduled for early publication*

Special Section on Food and Drugs  
Variations in Mortality from Heart Disease  
Patient Care in Proprietary Nursing Homes  
Biology of Northern Mosquitoes  
Microbiological Laboratory Safety  
Enigmas in Gonorrhea

Public Health Reports

Nile blue were made on renal tissue from 7 controls and 11 fluoride-treated dogs from groups 1, 2 and 3.

For mice the oral and intravenous lethal doses ( $LD_{50}$ ) were determined by using fasted, male, white mice of uniform weight (10 grams). Each dose level was evaluated in groups of 10 or more mice. The  $LD_{50}$  was calculated by the method of Litchfield and Wilcoxon (7). The arbitrary end point was 24 hours after administration.

## Physiological Effects in Dogs

### Group 1

Four dogs were given sodium fluoride by continuous infusion at a rate of 5.4 mg. of fluoride ion per minute to death. The mean acute lethal

dose was  $36.0 \pm 0.5$  mg./kg. (tables 1 and 2). An additional animal was infused at a rate of 1.1 mg. per minute to a lethal dose of 31 mg./kg. but is not included in the calculation of the mean acute lethal dose because of the difference in infusion rate.

No significant change in arterial blood pressure occurred until an average dose of 15 mg./kg. was reached. Beyond this point there was a moderate decrease in pulse pressure. From 20 to 30 mg./kg. there was a moderate fall in systolic and diastolic pressure, after which a rapid, progressive fall of blood pressure occurred (fig. 1).

Little change in mean heart rate was noted at low doses; however, after 20 mg./kg. had been given, there was a progressive decline in rate to zero at death (fig. 1).

Consistent electrocardiographic changes did

Figure 1. Respiratory and cardiovascular effects of sodium fluoride administration to group 1 dogs.

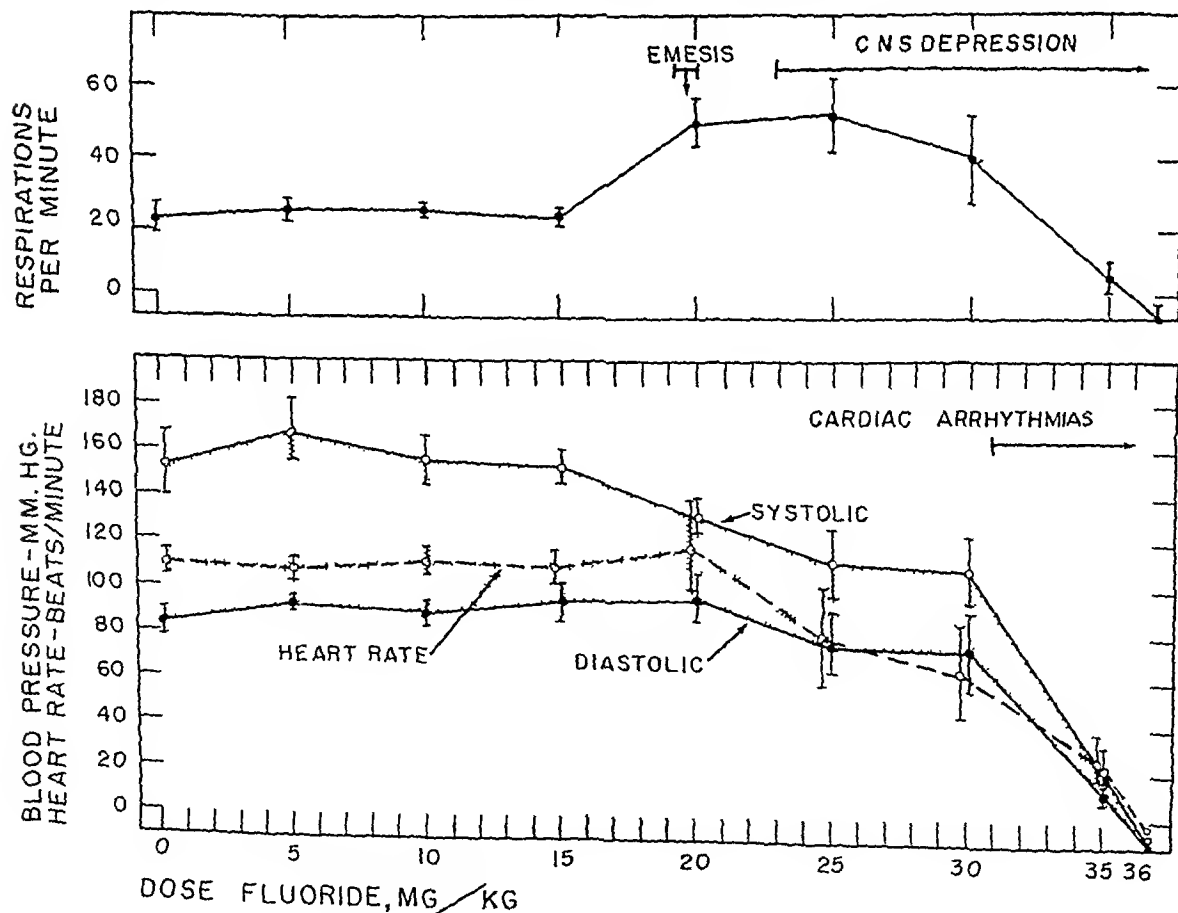


Table 1. Summary of fluoride effects in dogs

Dog group	Dose of fluoride <sup>1</sup> mg./kg.	Rate of intravenous infusion <sup>1</sup> mg./minute	Average body weight (kg.)	Number of dogs	Number of spontaneous deaths	Survival time
Group 1.....	{ <sup>2</sup> 36 31}	{5.4 1.1}	8.9	{4 1}	{4 1}	59-64 minutes. <sup>3</sup> 219 minutes. <sup>3</sup>
Group 2.....	{25 20}	{5.4 5.4}	9.3	{3 2}	{3 1}	1, 18, and 31 hours. 36 hours. 7 days (S).
Group 2.....	15	5.4		4	0	36 hours (S). 7 days (S). 16 days (S, 2 dogs).
Group 3.....	5	1	7.9	2	0	23 days (S).

<sup>1</sup> Doses expressed as fluoride ion. <sup>2</sup> Mean of 4 dogs. <sup>3</sup> Death occurred during continuous infusion.  
<sup>4</sup> Single intravenous injection given daily for 23 days. S=Sacrificed.

Group 4. Four animals were given sodium fluoride in single doses by mouth.

Group 5. Seven untreated dogs were sacrificed by exsanguination to provide normal control material for the pathological anatomy studies.

Under local anesthesia, the femoral artery and vein of the dogs in groups 1 and 2 were cannulated for recording arterial pressure and for intravenous infusion. Blood pressure was recorded with an Anderson glass capsule manometer (6). Respiratory rates and electrocardiograms were recorded by routine methods. In all groups, pupil size and reactivity, tendon reflexes, emesis, defecation, urination, and other significant behavioral and neurological changes in the animals were also observed. In groups 1, 2, and 4, blood was taken before and after administration of sodium fluoride for the determination of serum calcium.

The term "acute lethal dose," as used throughout, refers to that dose at which death occurred as the result of continuous intravenous infusion (group 1). The term "subacute lethal dose" arbitrarily applies to that dose of fluoride causing death one or more hours following administration (group 2).

A sterile, pyrogen-free solution of sodium fluoride (10 mg. of F ion per ml.) was used for intravenous administration; sodium fluoride powder was used for oral administration.

All doses are expressed in terms of the fluoride ion.

Necropsy was performed as soon after death as possible, in most instances immediately. Animals that did not die as a direct result of administered fluorides were sacrificed by exsanguination following sodium pentobarbital anesthesia. Necropsy was not performed on the animals that received fluoride by mouth. Tissues were fixed in 10 percent formalin for microscopic examination, and routine methods of tissue preparation, paraffin embedding, and hematoxylin and eosin stains were employed. Special fat stains using oil red O-hemalum and

Table 2. Emetic, cardiotoxic, and lethal doses of sodium fluoride during continuous intravenous infusion of group 1 dogs

Experiment dog No.	Dose <sup>1</sup> at which—			Terminal ECG event
	Emesis occurred	Arrhythmias appeared	Death occurred	
1.....	19.8	29.4	36.0	Asystole.
2.....	20.8	30.7	36.6	Asystole.
3.....	20.5	33.6	36.8	VF.
4.....	17.6	28.7	34.6	VF.
Mean.....	19.7	30.6	36.0	

<sup>1</sup> Doses expressed as milligrams of fluoride ion per kilogram. All animals infused at a rate of 5.4 mg. per minute.

VF denotes ventricular fibrillation.

not appear until a mean dose of 30.6 mg./kg. was reached, when there was conversion in every dog to atrioventricular nodal or ventricular rhythm. The terminal cardiac event was either ventricular fibrillation or asystole (table 2). Occasional changes in the amplitude and direction of the T waves and S-T segments were noted before loss of sinus rhythm but were not consistent. Durations of PR, QRS, and QT intervals did not change until abnormal rhythms occurred. Figure 2 illustrates the electrocardiographic tracings of a representative experiment.

On necropsy the hearts were usually found in systolic contracture. When arrested in diastole, slight mechanical stimulation of the heart induced contracture.

Average respiratory rates did not change appreciably until a dose of about 20 mg./kg. was reached, when an increase occurred. From 30 mg./kg. to the lethal dose, a progressive depression of rate was observed (fig. 1) as also was amplitude. In most of the animals there were frequent short periods of tachypnea, often occurring during the phase of central nervous system depression.

Depression of the central nervous system progressing to coma appeared in all group 1 animals at doses of from 23 to 31 mg./kg. Pupil size and reflex response to light were unaffected until moderately severe central depression developed. At that stage dilation and hypoactive reflexes were noted. Terminally, maximal dilation and areflexia of the pupils occurred. The corneal reflex persisted until the period immediately prior to death. Depression of tendon reflexes paralleled the central depression. Convulsions were not observed in the animals of this group in which the infusion rate was fast. However, in the one case with a slower infusion rate, a stage of neuromuscular hyperexcitability was prominent in the dose range of from 22 to 25 mg./kg. Characteristic of this phase were hyperactive tendon reflexes with clonus, tonic convulsions, and muscle fasciculations. This stage merged into the comatose state described in other animals.

Emesis and defecation were consistent effects with a mean emetic dose of  $19.7 \pm 0.8$  mg./kg. (table 2). Defecation usually occurred shortly before or immediately after emesis.

The dogs in group 2 were infused at the rate of 5.4 mg. per minute. The infusions were stopped at arbitrarily chosen fractions of the acute lethal dose of group 1 (15, 20, 25 mg./kg.), and the animals were observed until death or sacrifice.

Three dogs which received 25 mg./kg. of fluoride died within 1 to 31 hours after the end of the infusion. One of the two dogs given 20 mg./kg. died at 36 hours, while the other survived until sacrificed at 7 days. None of the four animals administered 15 mg./kg. died as a result of the fluoride. An approximate subacute lethal dose 50 ( $LD_{50}$ ) of 20 mg./kg., therefore, might be assigned to fluoride when given by this method of administration. Table 1 summarizes the results in this group.

Up to the point where the infusions were stopped in the group 2 animals, the cardiovascular and respiratory effects were similar to those of group 1 (fig. 1). There were no consistent electrocardiographic changes in these animals although recordings were not obtained in the period immediately preceding death in those animals which succumbed to the fluoride.

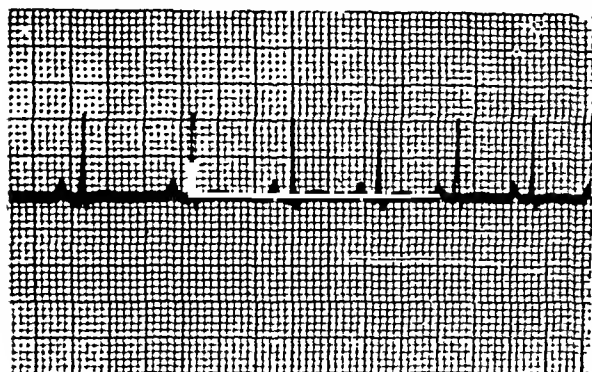
Depression of the central nervous system began before completion of the infusion in all three dogs given 25 mg./kg. and deepened progressively until death. Similar depression was observed in the animal that died as a result of 20 mg./kg. of fluoride. All of the other group 2 animals passed through a short stage of reduced activity, but no severe depression was observed.

Emesis occurred in all of the animals that received 20 or 25 mg./kg. Two of the four dogs receiving 15 mg./kg. of fluoride vomited about 30 minutes after cessation of the infusion.

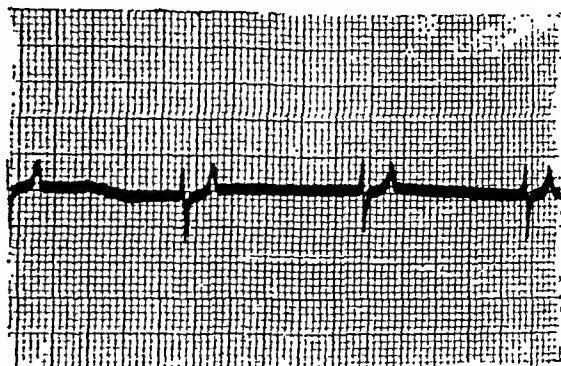
### Group 3

Group 3 consisted of two dogs given fluoride by daily intravenous injections of 5 mg./kg. for 23 days. Blood pressure and respiratory rates were not recorded. The animals remained in good condition with no evidence of toxic effects or weight loss. Electrocardiographs remained normal. The results are summarized in table 1.

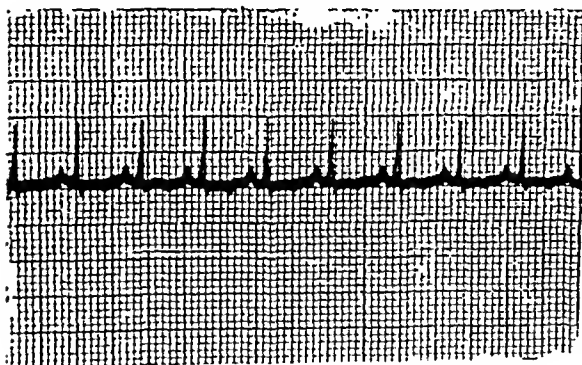
Figure 2. Electrocardiograph tracings (standard limb lead II) show the progressive effects of increasing doses of sodium fluoride on the heart of an unanesthetized dog. The rate of intravenous infusion was 5.4 milligrams of fluoride ion per minute in a 9.2 kilogram dog.



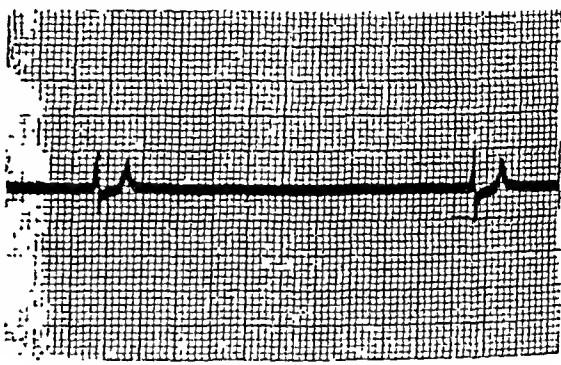
**Control**



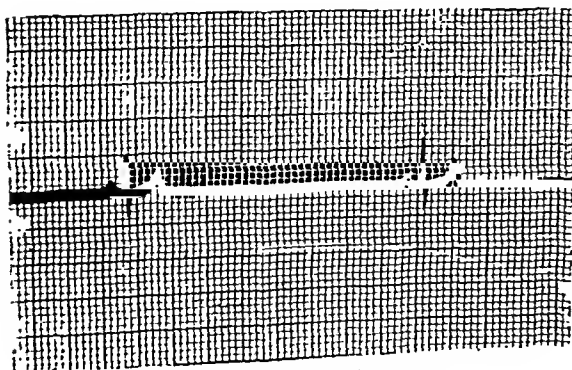
**28.6 MG/KG**



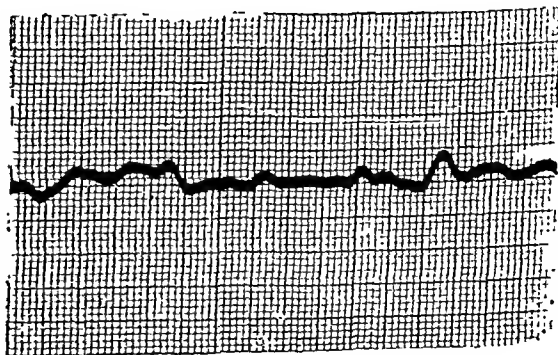
**17.6 MG/KG**



**31.8 MG/KG**



**23.4 MG/KG**



**34.6 MG/KG**

Microscopically, all animals that died after fluoride administration and one surviving until sacrificed at 36 hours showed generalized hyperemia and acute focal hemorrhages. All other animals showed some focal hyperemia and focal hemorrhages, but the conditions were no more severe than those in the control group.

Although special attention was given to brain, heart, liver, kidneys, lungs, gastrointestinal tract, and bone marrow, no other histological evidence of cellular injury could be found in any animal. Differences in fat concentration were found, but variations were as great among the controls as among the animals exposed to fluoride. The fat appeared to be liberated from the cytoplasm of the tubular epithelium, particularly along the cortico-medullary junction.

Incidental findings, common to the treated and the control dogs, included roundworm and tapeworm infestation of the intestinal tract and microscopic acute and chronic nonspecific inflammation of the lungs, kidneys, liver, and, less often, of the myocardium.

## Discussion

On the basis of the present study several points stand out in regard to the acute toxicity of sodium fluoride in dogs.

First, the doses of intravenously administered fluoride required to produce acute toxic effects in animals are high, and there is no evidence of cumulative effects on daily administration of sublethal doses for a period of 3 weeks.

Second, the more uniform effects with a constant rate of intravenous infusion of sodium fluoride are in contrast to the more erratic results and difficulty in producing toxic effects with oral administration.

Third, the physiological effects and pathological changes seen in dogs given toxic doses of fluoride resemble those reported in human fluoride poisoning (1-4).

The greater uniformity of results seen in groups 1 and 2 on intravenous administration is most evident in the relatively precise doses at which the various physiological effects occur. In contrast, the erratic results observed when fluoride is given to dogs by mouth are largely

due to the loss of undetermined amounts of the administered dose through vomiting.

Diarrhea and bloody stools were observed in some animals in which death was delayed from 1 to 36 hours. Similar findings have been reported in human cases (1, 3, 4).

The vasodepressor action of fluoride seen in this study has been demonstrated by Greenwood and associates (10). It probably is due to a combined depression of the vasomotor centers of the brain and of the vascular smooth muscle. The cardiac arrhythmias, resembling those resulting from high serum potassium, are probably caused by enhanced sensitivity of the myocardium to potassium, secondary to decreased serum calcium concentration. The terminal systolic contracture is of particular interest in view of Loewi's recent observations of a positive inotropic effect of sodium fluoride on the depressed frog heart (11). He suggests this action is caused by the formation of a complex of fluoride, a cellular constituent and calcium, and that this complex restores the cellular membrane excitability to normal. However, no conclusive evidence is available to suggest a comparable action in mammalian hearts.

The central nervous system and neuromuscular effects of sodium fluoride may be related to two actions: one, a reduction of ionizable calcium through a fluoride binding effect, resulting in a state of neuromuscular hyperexcitability, that is hypocalcemic tetany, and, second, a depression of the central nervous system as a possible result of enzyme inhibition (12).

Routine pathological studies did not demonstrate a specific mechanism of death in experimental fluoride exposure, but at the levels used in this study, and with the short interval to death in many instances, direct toxic cellular effects cannot be ruled out despite the lack of histological evidence of injury. The gross and microscopic pathological examination showed only generalized congestion and acute focal hemorrhages. Similar changes in man and animals have been described for deaths due to fluoride poisoning (1, 4, 13, 14). These changes are interpreted as resulting from injury to vascular endothelium.

Fatty changes have been described in the

#### Group 4

The four animals in group 4 were each given a single dose of sodium fluoride by mouth in powder form. One received the compound mixed in food and the others in gelatin capsules. Doses of 38, 81, 260, and 3,100 mg./kg. of fluoride were given. The main effects observed were vomiting and frequent defecation. In one case (3,100 mg./kg.) the vomitus was grossly bloody and the animal was mildly stuporous for a short period. In every dog in this group there was apparently complete recovery in 18 to 24 hours.

#### Physiological Effects in Mice

The oral  $LD_{50}$  with standard error was  $46.0 \pm 1.6$  mg./kg. as compared with an intravenous  $LD_{50}$  of  $23.0 \pm 0.9$  mg./kg. (table 3). Mice dying within 2 hours after injection showed successively cyanosis, dilatation of ear vessels, depression of respiration, tremors, clonic convulsions, paralysis of the hind legs, loss of righting reflex, depression, respiratory arrest, and death. Those with longer survival periods (2 to 24 hours) went through similar, but less severe, stages, progressing to a long terminal depression.

#### Serum Calcium and Blood Clotting

The effects of fluoride on serum calcium were determined on 11 dogs (table 4). Whole blood was drawn for serum calcium determinations prior to infusion and again immediately before death in the group 1 animals. In the group 2 animals, blood was drawn prior to and at the end of infusion. Blood was drawn from 1 animal in group 4 approximately 1 hour after administration. There was a slight drop in serum calcium in 9 of 11 animals. This finding has been reported by others (3, 8, 9).

Although no clotting-time determinations were done, soft, friable, poorly contracted clots were observed in blood samples drawn after fluoride administration.

#### Pathological Anatomy of Dogs

The only gross pathological changes noted in dogs were generalized hyperemia in the animals

that died after fluoride administration, whether acute or delayed and, in addition, focal hemorrhages in those dogs that died from 18 to 36 hours after fluoride administration.

**Table 3. Intravenous and oral lethal dose determinations of sodium fluoride in mice**

Dose of fluoride <sup>1</sup> mg./kg.	Ratio of deaths to mice used	Percent deaths
<i>Intravenous</i> <sup>2</sup>		
18-----	0/10	0
21-----	3/10	30
24-----	7/10	70
27-----	9/10	90
36-----	10/10	100
48-----	10/10	100
<i>Oral</i> <sup>3</sup>		
24-----	0/10	0
36-----	1/10	10
42-----	1/10	10
48-----	3/10	30
54-----	4/10	40
60-----	10/10	100
72-----	10/10	100
84-----	9/10	90

<sup>1</sup> Expressed as fluoride ion.

<sup>2</sup> Intravenous  $LD_{50} = 23.0 \pm 0.9$  mg./kg.

<sup>3</sup> Oral  $LD_{50} = 46.0 \pm 1.6$  mg./kg.

**Table 4. Effects of fluoride on serum calcium in 11 dogs**

Group	Number of dogs	Dose of fluoride <sup>1</sup> mg./kg.	Serum calcium mg./100 cc.	
			Prior to fluoride administration	Immediately after fluoride administration
1-----	3	<sup>2</sup> 36	8.94 6.51 8.00	7.23 7.75 6.70
2-----	3	<sup>2</sup> 25	11.15 8.50 8.60	9.65 6.50 7.20
2-----	2	<sup>2</sup> 20	10.30 9.70	10.30 9.40
2-----	2	<sup>2</sup> 15	9.20 9.40	8.60 8.20
4-----	1	<sup>3</sup> 3,100	8.50	7.90

<sup>1</sup> Expressed as fluoride ion.

<sup>2</sup> Intravenous administration.

<sup>3</sup> Oral administration.



Microscopically, all animals that died after fluoride administration and one surviving until sacrificed at 36 hours showed generalized hyperemia and acute focal hemorrhages. All other animals showed some focal hyperemia and focal hemorrhages, but the conditions were no more severe than those in the control group.

Although special attention was given to brain, heart, liver, kidneys, lungs, gastrointestinal tract, and bone marrow, no other histological evidence of cellular injury could be found in any animal. Differences in fat concentration were found, but variations were as great among the controls as among the animals exposed to fluoride. The fat appeared to be liberated from the cytoplasm of the tubular epithelium, particularly along the cortico-medullary junction.

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Fatty changes have been described in the

tubular epithelium of rat kidneys following prolonged administration of sodium fluoride (15). In our dogs, shift of renal fat was noted, but no consistent pattern could be found on comparison with the normal controls.

Reviewing the results of this study, it is interesting to compare the findings in animals with human cases of fluoride poisoning (1-4). Outstanding is the study of Lidbeck, Hill, and Beeman, who reported a mass accidental poisoning of 263 persons with 47 fatalities (1). They described respiratory and cardiovascular depression as a common finding in addition to a number of other manifestations also observed in the present study. An example is: "General collapse developed in most instances but at variable periods of time, apparently depending upon the concentration of the poison. This was characterized by pallor, weakness, absent or thready pulse, shallow, unlabored respiration, weak heart tones, wet cold skin, cyanosis, and equally dilated pupils. When this picture was pronounced, death almost invariably occurred." This description closely follows the findings in our animals receiving a fatal dose of fluoride.

In the present study and the clinical cases described by Lidbeck and associates, convulsions were not regularly observed. However, the carpopedal spasm and spasm of the extremities, described by these authors in a few patients who recovered or where death was delayed, resembled the neuromuscular hyperexcitability seen in one dog in the present study. These effects may be manifestations of hypocalcemic tetany. Generalized convulsions which have been described by others could be on the basis of cerebral anoxia or severe hypocalcemia (2).

On a practical basis, the data from this study may be of value in the evaluation and treatment of cases of acute fluoride poisoning in man. For instance, electrocardiographic demonstration of a cardiac arrhythmia in the absence of known heart disease would suggest that about three-quarters of the acute lethal dose had been absorbed and would imply poor prognosis. Central nervous system depression to a marked degree might also denote the absorption of more than half of a lethal dose.

The intravenous lethal dose of fluoride determined in the present study agrees well with

those previously reported if differences in injection rates and in species are considered (10, 16, 17).

This information, establishing the relatively high dosage of fluoride required to produce acute toxic effects in animals, suggests that small intravenous doses may be used with safety for human studies. The absence of toxic effects in dogs given 5 mg./kg. of fluoride intravenously daily for 3 weeks also suggests a considerable margin of safety and an apparent absence of accumulative toxic effects in this period of time.

### Summary

In this limited study, designed to evaluate the acute toxic effects of sodium fluoride in dogs and mice, it was demonstrated that:

1. The mean acute lethal dose of sodium fluoride in unanesthetized dogs infused to death by continuous intravenous infusion at the rate of 5.4 mg. of fluoride ion per minute was  $36.0 \pm 0.5$  mg./kg. The principal effects were progressive depression of blood pressure, heart rate, and central nervous system with vomiting and defecation, all occurring with the administration of approximately 20 mg./kg. At a mean dose of 30.6 mg./kg. there was a depression of respiratory rate and a conversion to atrioventricular nodal or ventricular rhythm with terminal ventricular fibrillation or asystole.

2. In a group of dogs infused intravenously with selected fractions of the acute lethal dose, an approximate  $LD_{50}$  was estimated to be 20 mg./kg. The major effects observed in this group were vomiting, defecation, and central nervous system depression. In the fatal cases death occurred in 1 to 36 hours.

3. In a group of dogs given 5 mg./kg. intravenous injections daily for 23 consecutive days, no toxic effects were observed.

4. In dogs, single doses up to 3,100 mg./kg. of fluoride by mouth produced only vomiting, defecation, and transient moderate depression.

5. The intravenous  $LD_{50}$  in mice was  $23.0 \pm 0.9$  mg./kg. and the oral  $LD_{50}$ ,  $46.0 \pm 1.6$  mg./kg.

6. A slight drop in serum calcium followed the infusion of fluoride in most dogs in which serum calcium was determined.

7. The pathological findings in those animals which died directly as a result of sodium fluoride administration consisted of generalized hyperemia and acute focal hemorrhages.

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## Inventory of Water Needs

At least one of every four large urban areas have reported they need additional water supplies to meet anticipated municipal and industrial growth, according to a nationwide inventory taken by the Water Supply and Water Pollution Control Program of the Public Health Service.

Of 1,532 community water facilities, 367 serving a population of nearly 20 million need additional water supplies. About one-fourth of the water supply facilities need additional distribution systems, partly because of the growing practice among municipalities to provide water service to suburban areas. More than half of the facilities need improvement or enlargement.

The inventory covered all facilities serving 10,000 people or more and a 40-percent sample of facilities serving between 5,000 and 10,000 people. It lists population served, source of supply, treatment provided, capacity, storage, and the improvements which local officials consider necessary to maintain satisfactory service. Additional details are available from the Water Supply and Water Pollution Control Program, Public Health Service, Washington 25, D. C.

# Accident Prevention In Sanitation

By EDGAR F. SEAGLE, M.S.P.H.

THE ESSENTIAL points of this paper have been used to introduce to local health department personnel in North Carolina the close relationship between good sanitation practice and accident prevention. This concept of sanitation, though obvious in principle, seems to be difficult for many health workers to visualize in specific terms. The following examples, presented at State and local health staff conferences, appear to have improved acceptance and understanding of this concept and to have advanced and encouraged its many applications, with good results for sanitation all around.

A change of concepts has been characteristic of the progress of sanitation services. For example, not too many years ago sanitarians dressed like policemen and worked principally on the basis of enforcing laws which neither they nor their clients thoroughly understood. Sanitarians today dress like teachers or salesmen, and they work primarily to promote sanitation on its own merits, with a foundation of public acceptance, understanding, and approval. The word sanitation itself illustrates how concepts have changed. For many years, it has been associated primarily with cleanliness. But its original meaning was the protection of health; and that original meaning is restored to the extent that sanitarians broaden their responsibility and understanding.

Accident prevention is one program for protecting health which forces sanitarians to look

beyond details of neatness and cleanliness toward the true objectives of their work. At the same time, accident prevention enjoys much broader public understanding and acceptance than the processes of preventing contamination of food by invisible microbes. It is not only within full ken of human experience, but it also appeals directly to self-interest. Everyone is certain to be more concerned with a possible accident to themselves than with the uncertain and indirect effects of his habits on others.

## Control of Hazards

To illustrate how accident prevention can play an important role in the improvement of sanitation, consider first the food handler working in the kitchen of a restaurant. If this person has an open cut or wound on his hand while preparing certain foods, the potential for contaminating this food with infectious bacteria is certainly high. Of course, if this person has been well schooled in proper food handling, he would not work with an open cut, but how many are so trained? The safe approach is to prevent such an accidental cut if possible. In one instance, every time a food handler reached for a certain pan he either scratched or cut his hand on a sharp edge of metal on the side of the storage cabinet. If this environmental hazard had been corrected, the food handler would not have had so many cuts. At the same time, his potential of food contamination would have been less. The manager might be induced to correct such conditions more readily if the element of personal pain and suffering, as well as liability for workman's compensation, had been discussed along with the food infection hazard. This approach also gives a client the feeling that you are interested in him personally and helps to secure cooperation.

Sanitarians have long been concerned with the cleanliness of floor and wall surfaces. To maintain cleanliness they should be made of smooth, washable, nonabsorbent material, free from cracks, crevices, and open joints. Such a surface certainly is a poor place for germs to

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take a foothold. It also, however, contributes to safe walking and movement on the premises. The fact that floor surfaces, if properly constructed, contribute not only to cleanliness but to safety is another example of how accident prevention can strengthen a sanitation program. It also illustrates that sanitarians have been engaged in accident prevention often without directly realizing what they have achieved.

Restaurant and meat market regulations usually require adequate lighting and ventilation. Here again these regulations were primarily set up in the interest of cleanliness; that is, if you can see dirt, you can clean it up. Another important advantage in good lighting though is to reduce accidents. Poorly lit cellars or stairs need no comment: Their high potential as a source of falls resulting in disabilities and death is too well known. Good lighting is certainly needed to see that equipment is effectively washed and cleaned. However, good lighting at the cutting, mixing, or grinding table in the kitchen may prevent a slash to a finger or hand. Many a hand is caught in a piece of equipment because the moving parts are not clearly seen in a dim light. Here again, the accident prevention concept for the operator or foodhandler is a strong supplement to sanitation.

Garbage cans also may figure in preventing accidents. For example, many garbage cans of food-handling establishments sit on back platforms, to be emptied daily. When there are enough cans, there is less spilling refuse and other wastes and the walking area is more likely to be dry and clear. However, if garbage cans overflow, meat scraps, bones, rubbish, offal, filth and other wastes are strewn over the back platforms and eventually are kicked or carried into the kitchen. Articles of this kind provide a slippery underfooting and may provoke a bad spill or fall as much as a broom or other heavy litter in the walking area. Therefore, walkways clear of garbage discourage breeding of flies, rodents, and germs, but also discourage the chances of accidental falls.

It is recommended that merchandise in the storage room be stored on elevated platforms to facilitate cleaning. If this recommendation is carried out, things are certain to be more in order than if they are strewn on the floor at

random. Here also, the possibility of tripping and falling is reduced. Again, neatness and accident prevention join in the common cause of sanitation.

### Farm Sanitation

Examples of sanitation improvement by eliminating accident producing environmental conditions can be found also on farms and in dairies. Uncovered holes or slick surfaces on graded levels around the barn may result in cows slipping and injuring their udders. Such injuries in turn may produce mastitis. Mastitis means not only an economic loss to the farmer but may also mean a possible danger of infection in the milk. However, an employee or the farmer himself may fall and break a leg in these same danger spots. Therefore, if farm sanitation work is done with an eye towards protecting the farmer as well as the cow from accident, both may benefit. Such hazards are typified also by discarded pit privies. If these are effectively filled in, there is less possibility of spreading disease; however, the fill also reduces the chances for an accident. Discarded wells also should be filled in or securely covered, for similar reasons.

As to insect and rodent control, the North Carolina State Board of Health is pursuing a project which although designed primarily to prevent mosquito breeding also prevents many home accidents. This project is that of inspecting every home and farm pond and stressing that all tree stumps and other obstructions be completely cleared from the pond bed. The regulation calls only for these stumps to be a certain number of inches below the fluctuating water level. However, sanitarians strongly recommend complete clearing of the pond bed. They then accomplish both the primary purpose and also eliminate the chance that swimmers diving in the pond may hit their heads on these obstructions, as well as the threat to boats on the larger ponds. If a farmer is reluctant to believe that these stumps have any important relation to mosquito breeding, he may be more readily convinced that some member of his family can be seriously injured or killed if the stumps remain.

There are many other examples of the close relationship between accident prevention and other phases of sanitation.

In North Carolina, studies have shown that there were 825 accidental deaths in 1954 on the farm and in the home. This is a rate of approximately 2 deaths per day. It has been estimated that for each of these fatal accidents, there are 150 accidental injuries resulting in disability for 24 hours or longer, and 4 of these are permanent disabilities. Any accident prevention activity should be preceded by an in-service training program for sanitarians and a

check list of home hazards agreed upon and approved. Armed with this knowledge, the sanitarian could then discuss such situations on the spot and make recommendations for the most practical means of elimination or correction. Such a program may be used by all categories of public health personnel who visit the public in their daily duties. Accidents are unquestionably one of the major health problems. Sanitation personnel have a great opportunity to combine accident prevention activities with their existing programs. Such a forceful combination would add even greater satisfaction to their present valuable work.

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## Galactosemia Cause Found

The cause of galactosemia, also known as galactose diabetes, an often fatal metabolic disease of children, has been discovered by scientists of the National Institute of Arthritis and Metabolic Diseases, Public Health Service. It was reported in official announcements on March 12, 1956.

This disease ordinarily appears within a few days after birth. The infant suffering from galactosemia is unable to utilize or even tolerate milk in any form. Lactose, often called milk sugar, contains another sugar, galactose. This substance cannot be handled by the child's system if he has galactosemia.

Drs. Herman M. Kalckar, Elizabeth P. Anderson, and Kurt J. Isselbacher at the National Institutes of Health discovered a hitherto unknown enzyme in normal red blood cells, which they call P-Gal transferase. This enzyme, they found, is necessary to complete conversion in the body of galactose into glucose, the common sugar of the blood.

Diagnosis of galactosemia is difficult because the symptoms are similar to those of other disorders. Diarrhea, lack of appetite, loss of weight, and jaundice appear in the earlier stages. In later stages, the disease leads to cirrhosis of the liver, mental retardation, blindness due to cataract, and death.

Early recognition of galactosemia is highly important, since the disease progresses rapidly, leaving serious irreversible changes. When diagnosed in an early stage, treatment is simple. The affected child, placed promptly on a milk-free diet, will grow and develop normally.

The discovery of P-Gal transferase promises to provide a rather simple diagnostic test, making earlier life-saving treatment possible. It also points the way to exploration of the possibility that impairment of galactose metabolism may be a factor in other disorders of unknown origin.

*The model poultry ordinance as it now stands deals only with the general enforcement and sanitary provisions. A part dealing with inspection is to come.*

# Development of a Poultry Ordinance

By JOE W. ATKINSON, D.V.M.

THE Public Health Service has developed a model poultry ordinance for voluntary consideration by State and local agencies which are conducting or planning inspection and sanitation activities regulating the processing, storage, transportation, and sale of poultry and poultry products. Why and how was the ordinance developed? What is its potential value?

## Background

The poultry industry has doubled in size since 1940. In 1953, it was the third largest source of gross farm income, representing 12.1 percent of the total. The value of poultry and poultry products, including eggs, was almost \$4 billion at the farm level and \$6 billion at the retail level. Per capita consumption of poultry meat reached 34.4 pounds.

A radical change in buying habits and merchandising methods has accompanied this tremendous growth. The consumer seldom sees the live bird to evaluate its health. Processing has progressed from on-the-spot slaughter, observed by the customer, to production line methods. The product may be stored for ex-

tended periods, shipped long distances, and consumed far from the point of origin. This mass processing and distribution has presented new problems in meeting standards of consumer expectancy and of public health.

## *Diseased Poultry*

Noteworthy progress has been made in the prevention and treatment of poultry diseases, yet a substantial number of diseased birds are marketed. Entire flocks may be sent to slaughter in an attempt at salvage when disease outbreaks appear. The production of large commercial flocks in crowded facilities and concentrated areas heighten the possibility of the dissemination of disease, as shown currently by the high rate of respiratory diseases in areas of concentrated broiler production. The number of pounds of poultry condemned by the Poultry Inspection Branch, Department of Agriculture, as unfit for human consumption ranged from 4,075,121 in 1951 to 6,960,529 in 1954 (table 1).

In the poultry processing industry, as in other industries, the advent of mass production operations has brought increased occupational health problems. During recent years, scattered outbreaks of psittacosis among employees of poultry-processing establishments emphasized the necessity for adequate ante-mortem and post-mortem inspection of poultry, high standards of sanitation, and special protective measures in reducing possibilities of employees' becoming infected while at work. A transmissible disease may assume increased public

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*Dr. Atkinson is consultant, Poultry Inspection and Sanitation, Milk and Food Program, Division of Sanitary Engineering Services, Public Health Service. He presented this paper at the Ohio Valley Conference of Food, Drug, and Health Officials, held in Cincinnati October 26, 1955.*

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Table 1. Summary of post-mortem examination of poultry, Department of Agriculture, 1951-1954<sup>1</sup>

Item	1951		1952		1953		1954	
	Number of plants under inspection							
	189 (Oct. 15)		221 (Oct. 13)		235 (Oct. 1)		257 (Oct. 1)	
Weight (pounds):								
Inspected.....	694, 530, 135		902, 907, 357		1, 003, 841, 374		1, 139, 703, 950	
Certified.....	690, 455, 014		897, 141, 239		997, 811, 515		1, 132, 743, 421	
Condemned.....	4, 075, 121		5, 766, 118		6, 029, 859		6, 960, 529	
Percent condemned.....	. 58		. 639		. 60		. 61	
Carcasses condemned								
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>
Tuberculosis.....	241, 417	19. 97	266, 910	17. 043	230, 777	12. 52	177, 291	9. 24
Emaciation.....	37, 054	3. 07	45, 561	2. 909	43, 840	2. 38	29, 938	1. 55
Septicemia and toxemia.....	290, 550	24. 03	400, 610	25. 581	573, 591	31. 11	634, 386	32. 97
Leucosis.....	138, 114	11. 42	167, 786	10. 714	152, 046	8. 25	154, 923	8. 05
Tumors.....	101, 792	8. 42	123, 011	7. 854	96, 323	5. 23	122, 202	6. 35
Inflammatory processes.....	200, 194	16. 56	329, 953	21. 069	524, 547	28. 45	591, 270	30. 73
Parasites.....	1, 409	. 12	3, 976	. 254	2, 385	. 13	1, 450	. 08
Gout.....	803	. 07	1, 626	. 104	2, 065	. 11	777	. 04
Bruises.....	42, 238	3. 50	54, 637	3. 489	62, 056	3. 37	56, 068	2. 91
Contamination.....	37, 994	3. 14	58, 297	3. 723	53, 587	2. 91	60, 622	3. 15
Decomposition.....	87, 100	7. 21	65, 633	4. 191	33, 637	1. 82	24, 481	1. 27
Cadaver.....	13, 031	1. 08	24, 748	1. 580	34, 132	1. 85	34, 808	1. 81
Overseald.....	11, 256	. 93	12, 457	. 795	17, 820	. 97	13, 136	. 68
Other causes.....	5, 825	. 48	10, 872	. 694	16, 640	. 90	22, 596	1. 17
Total.....	1, 208, 777	100. 00	1, 566, 067	100. 000	1, 843, 446	100. 00	1, 923, 948	100. 00

<sup>1</sup> Adapted from annual summaries prepared by the Poultry Division, Agricultural Marketing Service.

health significance through a previously unknown strain of the infective organism, through the adaptation of a known strain into a form more highly virulent to man, or through certain conditions which enhance the transmissibility of the disease from the animal host to man or from man to animal (1).

### *Insanitary Conditions*

The 1950 annual report of the Food and Drug Administration stated: "In the meat and poultry projects, major attention from a filth standpoint was given to poultry that was decomposed or contaminated by fecal matter in washing and scalding tanks."

Quoting from the report for 1951: "Poultry ranks third in the number of filth and decomposition charges. When meat prices increased, many inexperienced operators entered the field of poultry production. More than three times as many seizures of unfit birds were made as in the previous year. The main causes of com-

plaints were contamination by fecal matter, preparation under unsanitary conditions and diseased, improperly dressed birds."

And the 1952 report said: "There was continued pressure to improve the sanitary handling of poultry in dressing plants and eliminate traffic in diseased birds. Plants visited ranged from "pot scalders" to assembly line establishments dressing 600,00 pounds of broilers in a 24-hour day. Conditions varied from excellent to repulsive, regardless of size or type of equipment. About 200,000 pounds were seized."

### *Foodborne Outbreaks*

The types of *Salmonella* that frequently cause foodborne illness in man are commonly found in poultry. Furthermore, although in many instances the poultry probably is not the original source of the organisms, processed poultry, poultry products, or poultry dishes, such as pies, salads, "dinners," are frequently contaminated with Arizona paracolon, staphy-



lococci, or other organisms associated with food-borne outbreaks.

Feig's analysis of food infections and food poisonings in man shows poultry to be one of the common vehicles incriminated in food-borne outbreaks caused by food other than milk (2). Of such foodborne outbreaks reported by the States to the Public Health Service, the percentage of cases associated with poultry and poultry dishes has been relatively high since 1945 (table 2).

Dauer stated in his summary of disease outbreaks (3): "Poultry and eggs were far more important than milk or water as sources or vehicles of infection. . . . These reports very clearly indicate that fowls and eggs constitute a large reservoir of infection, and they emphasize the need for more effective methods to prevent transmission of infection to man." In the 1953 summary (4), Dauer and Sylvester reported that in one-third of the outbreaks caused by *Salmonella*, chicken or turkey was found to be the vehicle of infection. Of the total of 209 waterborne and foodborne outbreaks, involving 10,730 cases reported by the States in 1953, 65 outbreaks (31.1 percent), involving 4,696 of the cases (43.7 percent), were associated with poultry. These percentages are based on reports from the National Office of Vital Statistics.

In foodborne outbreaks, epidemiological studies are often incomplete. Yet, it has been shown from the number of cases reported that, unless adequate preventive measures are continuously effected, poultry or poultry products may serve as a source or vehicle of infection (5-7). For this as well as for other reasons, health authorities have recognized the need for poultry inspection services and for adequate sanitation and refrigeration in the processing and subsequent handling of poultry and poultry products (8, 9).

#### *State and Local Problems*

The Food and Drug Administration regularly examines poultry shipped interstate and inspects the plants of origin. Furthermore, approximately 25 percent of the poultry processed in this country originates in establishments voluntarily operating under the poultry

inspection service of the Department of Agriculture. Nevertheless, it is estimated that approximately 70 percent of the poultry processed is not inspected by either the FDA or the Department of Agriculture. This is due, in part, to limitations on funds available for the purpose under the FDA programs and to the fact that inspection by the Department of Agriculture is not mandatory for all poultry shipped interstate. Furthermore, more than half of the poultry consumed in the United States is sold within the States in which it is processed and is not necessarily subject to these Federal programs.

Consequently, extensive problems remain for State or local control. Some jurisdictions have recently revised or adopted regulations. In a few instances, the mere variety of proposed regulations has threatened the industry with trade barriers. Other jurisdictions are aware of the need for uniform action and have requested guidance, including a suggested ordinance, from the Public Health Service. Added to these requests from health officials were the recommendations in 1952 of the Conference of State and Territorial Health Officers and of the United States Livestock Sanitary Association that a model ordinance be developed to aid the States in strengthening their poultry sanitation.

**Table 2. Number and percentage of cases associated with poultry and poultry dishes from total of cases in foodborne outbreaks (attributed to all foods other than milk and milk products)<sup>1</sup>**

Year	Total cases reported	Associated with poultry	
		Number	Percent of total
10-year total	97, 485	31, 832	32. 6
1945	11, 465	1, 994	16. 5
1946	11, 702	5, 039	43. 0
1947	11, 218	3, 229	28. 7
1948	9, 127	2, 682	29. 3
1949	8, 237	2, 843	34. 5
1950	10, 096	2, 581	25. 5
1951	7, 194	2, 995	41. 6
1952	6, 828	3, 150	46. 1
1953	9, 914	4, 696	47. 3
1954	11, 704	2, 623	22. 4

<sup>1</sup> As reported by the States to the Public Health Service.

tion programs. That same year the Institute of American Poultry Industries offered to assist the Public Health Service in the development of such an ordinance.

### The Ordinance

The Public Health Service poultry ordinance has been developed as a joint project of the Milk and Food Program, Division of Sanitary Engineering Services, in Washington and the Veterinary Section, Epidemiology Branch, Communicable Disease Center, in Atlanta.

Field studies were conducted, and existing State and local regulations and programs were reviewed. Following completion of a first study draft of the general enforcement and sanitation provisions of the ordinance, a Public Health-Poultry Industry Liaison Committee has acted as an advisory group in its further development. This liaison committee is composed of seven members from the Public Health Service and State and municipal health departments and an equal number of members from the Institute of American Poultry Industries. The committee outlined three broad objectives:

1. Poultry should be handled only in clean establishments in a clean manner.

2. Only wholesome poultry should be offered to the consumer.

3. All trade barriers not based on sound public health principles should be avoided.

A study draft of the general enforcement and sanitation provisions of the ordinance was distributed for review and comment to major organizations of the poultry industry, to State and local agencies, and to many National organizations composed of health officials or related professional personnel.

Representatives of the Department of Agriculture, the Food and Drug Administration, and the Department of Defense were consulted at frequent intervals. They reviewed the study drafts and offered many helpful suggestions for revisions. Substantial agreement was reached on all general enforcement and sanitation requirements of the ordinance, and they were published in April 1955 as the Poultry Ordinance, 1955 edition (Public Health Service Publication No. 444).

Provisions dealing with ante-mortem and post-mortem inspection of poultry have been developed in draft form and submitted in a similar manner to the industry and to many interested agencies and groups for review and comment. These provisions are to be completed during this fiscal year.

### Basis of Provisions

The provisions of the ordinance are based on the following considerations:

1. Diseased poultry may be a source or reservoir of diseases transmissible to man, including salmonellosis, erysipelas (causing erysipeloid in man), Newcastle disease, psittacosis, and various dermatoses.

2. Body discharges and dust from live poultry may be a source of pathogenic organisms, including those of the colon and paracolon types.

3. Insects may contaminate foods with etiological agents which may cause diseases such as typhoid fever, bacillary dysentery, and paratyphoid fever.

4. Rodents may contaminate water and food with hair, feces, and urine. Particularly noteworthy is the fact that *Leptospira icterohaemorrhagiae* excreted in the urine of wild rats has been reported as a principal cause of leptospiral infections in man. Rodents may be carriers of salmonellosis, lymphocytic choriomeningitis, tapeworms, and protozoans.

5. Poultry-processing wastes contain those organisms found in the body discharges of poultry, such as the *Salmonella* and other colon and paracolon types.

6. Sewage, if not properly disposed of, may be a direct or indirect source of contamination of foods with pathogenic organisms causing such diseases as bacillary dysentery, typhoid fever, and paratyphoid fever.

7. Water and ice not known to be safe may contain those species of organisms which cause such diseases as bacillary dysentery, leptospirosis, typhoid fever, and paratyphoid fever.

8. Infected employees may transmit diseases directly to fellow employees. They may contaminate foods with the causative organisms of such diseases as bacillary dysentery, salmonellosis, typhoid fever, paratyphoid fever, tuberculosis, and staphylococcal and streptococcal infections.

9. Extraneous materials in foods may cause physical injury to the consumer or be a source of contamination; rodenticides, insecticides, and various chemicals may be poisonous to man if consumed.

10. Proper refrigeration is necessary to prevent growth of micro-organisms and production of toxins in poultry and poultry products.

11. Food products offered for sale should be plainly identified and labeled with no misrepresentation.

12. The standards of consumer expectancy for foods, have, in effect, been delineated by Congress in the definitions of adulteration and misbranding as contained in the Federal Food, Drug, and Cosmetic Act; whether at the Federal, State, or local level, food-control regulations should be designed to obtain compliance with these standards.

### *Potential Values*

The full value of the Public Health Service poultry ordinance will not be determined until it has been adopted, or at least used as a guide, by several State or local agencies as a basis for their poultry regulatory programs.

Experience in State and local milk sanitation activities has shown that the value of regulatory programs affecting food is greatly improved by a uniformity, within many jurisdictions, of requirements and enforcement procedures. This is not an interstate problem only. Uniformity of regulations and acceptance of products between local jurisdictions within a State can often be just as important to those concerned as is the case with products shipped from one State to another. There is ample reason to believe that adequate, uniform poultry regulatory programs will be of benefit to the poultry industry, the consumers, and the enforcement agencies concerned.

Such uniform programs will assist the industry in maintaining the gains of recent years and in making further progress through wide distribution of an ever greater variety of products. They will help to assure acceptance of products by the regulatory officials and by the consumers of other jurisdictions, making possible the competition which is essential for an expanding industry.

Industry members will be relieved of the ex-

pense and uncertainty of attempting to conform to conflicting requirements within the various jurisdictions where they may wish to distribute their products and will profit from increased sales in the communities where all poultry and poultry products offered for sale are consistently of high sanitary quality.

Employees' increased pride in their duties and their place of employment will contribute to increased efficiency and better products, resulting in better public relations. There will be less employee turnover, and the expense of training inexperienced personnel will be reduced.

Consumers in affected jurisdictions will receive the inestimable benefit of improved health protection and the assurance that products purchased meet standards of consumer expectancy. They will buy and enjoy with confidence the poultry and poultry products offered for sale in their community. While traveling on business or vacation trips through other jurisdictions having comparable requirements and enforcement procedures, they will have similar confidence in the wholesomeness of poultry dishes served to them en route.

It is significant, also, that uniform regulations and acceptance of products from other jurisdictions contribute to the variety of nutritious and appetizing foods available at competitive prices. Such variety and prices are directly essential to the health and happiness of the average consumer.

Regulatory agencies will benefit from the active cooperation of the poultry industry. This cooperation will be forthcoming only when the regulations are uniform, reasonable, and consistently enforced.

Widespread uniformity of regulations will help resolve the difficult, and sometimes costly, problems which face the regulatory agency in deciding whether to permit the sale of food products from other jurisdictions.

These safeguards for the health and interest of employees and consumers will be recognized and will result in respect and support of the regulatory agencies.

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## technical publications

### VD Fact Sheet

*Public Health Service Publication No. 341. December 1955. 21 pages; 15 tables.*

Basic statistics on various aspects of the venereal disease control problem have been compiled to provide a handy source of information for those persons interested in public health and venereal disease problems.

In tabular form are estimated annual costs of uncontrolled syphilis, reported mortality and insanity due to syphilis in continental United States, and cases of syphilis and gonorrhea reported to the Public Health Service. Analysis of syphilis morbidity by age, results of penicillin therapy in the treatment of congenital syphilis and secondary syphilis as well as results of health department case-finding activities are also included.

Explanatory text accompanies the tables. Information is current as of the date of publication and supersedes any previously published data.

### The Child With Rheumatic Fever

*Children's Bureau Folder No. 42. 1955. 13 pages. 10 cents.*

The most recent folder in the Children's Bureau series, addressed to

parents and covering conditions that cripple, or may cripple children, emphasizes the preventive value of early diagnosis and treatment of a strep throat—a condition which usually precedes an attack of rheumatic fever. It describes the role played by such medicines as penicillin and the sulfa drugs in combating the infection.

Only a doctor can determine when a child has a strep throat, the folder points out. Listed are signs the parents should call to the doctor's attention.

The folder covers the care of the child who already has rheumatic fever and makes suggestions that will help in keeping him content during the important, and often lengthy, convalescent period.

### Reading on Cancer. An Annotated Bibliography

*Public Health Service Publication No. 457. 1955. 16 pages. 15 cents.*

Books, pamphlets, reports, and articles in popular periodicals and professional journals are included in this 1955 bibliography on cancer, prepared by members of the Cancer Reports Section of the National Cancer Institute. Major emphasis is given to information from nontechnical sources, and, for the most part,

the references are not more than 5 years old. Only material in the English language is included.

A section entitled "Related Reading" lists references on such subjects as atomic energy, medical research, popular science, and science-health career opportunities. There are also references in the field of geriatrics, preventive and psychosomatic medicine, and medical history and biography. After each entry, the letter "E," "M," or "D" appears in parentheses showing whether the material is "easy reading," "moderately difficult," or "difficult." All the entries are annotated, and a topical index is included.

Booklists provide bibliographies of professional material for detailed study of specific aspects of cancer, and sources of cancer information are given.

This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

*Organized efforts to increase group enrollment in health insurance in four communities in a western North Carolina county produced impressive results, especially with farmers and low-income rural families.*

# Extending Voluntary Health Insurance Through Community Organization

By DONALD G. HAY, Ph.D., and SELZ C. MAYO, Ph.D.

EXISTING GROUPS can be of major help in extending programs for prepayment of health care costs, and this paper reports how community organization functioned to promote health insurance enrollment in one rural area.

In 1951, group enrollment in health insurance was a specific activity of the Haywood County (N. C.) Community Development Program. Most organized communities in Haywood County are of the open-country type, and the area here reported includes four such localities (1), each known locally as a community. Sociologically, these localities are more "neighborhood" than "community" in character since none has a population center with a complete set of trade and other services. The communities have very few special interest organizations

other than churches and a home demonstration club sponsored by the agricultural extension service.

## Community Organization

In 1949, the agricultural extension service, in cooperation with other professional workers, began a program in Haywood County through which the local residents of each open-country community would undertake a community development program. Because there were few special interest organizations in these communities, coordination of activities was not a problem.

The organizational structure created to carry out the development program is known locally as the community club. The community club performs the major functions of study and planning and directs specific actions within the community. In the literature dealing with community organization, this type of organizational structure is classified as a form of the direct type of community organization.

Each of the four locality groups in the study contained a community club. In 1954, these clubs carried out their development programs through the following officers and committees:

1. Chairman, vice chairman, secretary, treasurer, and reporter. These officers were elected at regular, communitywide meetings.

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2. Six standing committees: survey, planning, program, recreation, refreshment, and scrapbook.

3. Special committees appointed to develop particular farm production enterprises for the community: tobacco, corn, hay, pasture, beef, dairy, and poultry.

4. Other committees designed to promote development of health, foods and nutrition, roads, and youth activities.

A study (2) was made of the organizational structure, operational procedures, and programs of one of these communities. Regular communitywide meetings are held each month in the educational wing of a local church. One of the most pressing needs, consequently one of the goals for 1954, was construction of a new center to be used for meetings and other community activities and to aid in the development of educational work in the community. A special committee was charged with this responsibility.

Each community meeting opens with devotions. A business session follows, during which plans are made, new programs are adopted, and committee reports are presented. Next there is an educational program, which may be centered on agricultural practices, international relations, such as a film on rural life in India, or explanations of a voluntary health insurance plan. The meeting closes with a recreation and refreshment period, which may include community singing and a supper or light refreshments.

One of the first steps in each community during the period of creating the community club was to identify the community boundaries. When this decision had been reached by the original interested group, community identification signs were erected on each road or highway running through the community. These signs circumscribe the community and, in a highly organized county, virtually every family is a member of the community "in-group," as determined by these boundaries. It is particularly necessary to emphasize the importance of this operational procedure since it is through this means that the identity of the "group" is determined for the voluntary health insurance program.

There are no dues and no membership rolls

for the community meetings; the number of families in the in-group is determined by community boundaries, not by the number of families whose members attend the meetings. To aid in understanding the actual operation of the voluntary health insurance program of the communities, one other aspect of the organizational structure in Haywood County must be noted in some detail, the county organization of the community development program.

The county organization was designed to coordinate and promote the activities of the community clubs throughout the county. In 1954, this work was carried out through the following officers, directors, and commissions operating under the name of the Haywood County Community Development Program:

*County Officers.* Chairman, vice chairman, reporter, secretary, and treasurer. County officers were elected from among community officers and members.

*Board of Directors.* Chairman, vice chairman, secretary, treasurer, and eight regular members. Both men and women were included. This group was responsible for developing policy and administering the community development program on the county level.

*County Planning Commissions.* County commissions were established in accordance with the major needs of the county and in accordance with the major activities of the community clubs. Countywide commissions were established or were to be created in connection with specific agricultural enterprises, recreation, and health.

This is the organizational structure and process within which the promotion of voluntary health insurance on a group basis is and has been pursued in Haywood County.

### Group Health Insurance

The health insurance purpose of the Haywood County Community Development Program was stated in the 1951 Annual Report of the County Agricultural Extension Agent as follows: "The officers and directors of the community development program are very much interested in securing for the rural people of Haywood County the same benefits received by industrial and common-employer groups in

the county from group hospital and surgical insurance."

In addition to being an "organized community," each of the four localities had churches and one or more other organizations, such as home demonstration clubs. However, each organized community, in addition to being an integral unit of the countywide community development program, enjoyed a wide reach of participants through its embraceive program of activities and, therefore, was in a key position to serve as a group base for enrollment in voluntary health insurance.

The possibility of developing a voluntary health insurance program was first discussed at a regular monthly meeting of each organized community. A local physician and a member of the countywide board of directors of the community development program presented general information on such insurance. The members, after some discussion, voted in favor of having the county board of directors proceed to seek a definite group health insurance plan.

During a period of 6 to 8 months, a specific plan was worked out with an insurance carrier and the necessary arrangements were made through the State Insurance Commissioner for the community development program to serve as a basis for enrollment in a group health insurance plan. The specific insurance program was presented at another regular monthly meeting of each organized community. Those participating actively at this second round of local meetings were local physicians, the local hospital administrator, a member of the county board of directors, and a representative of the insurance carrier. Community members voted to support the insurance program, and campaigns for enrollment in each community followed.

The fact that each community achieved the necessary 75-percent enrollment of all families, counting those already enrolled in a work-group employment plan, to qualify for the group enrollment arrangements reflects the strong local support given to the program.

In each community, a local person serves as chairman for the health insurance activity, collects premiums on a quarterly basis, and furnishes information on the insurance plan. He also is expected to stimulate new memberships

in the group enrollment plan, which is opened semiannually for new members. This local collector is paid a small fee by the members.

Group enrollment in voluntary health insurance through the Haywood County Community Development Program began in June 1951. Insurance was carried with a commercial insurance company for the first year. In June 1952, a nonprofit agency took on the health insurance program, and in January 1954 another nonprofit agency became the carrier. The community development program has been able to "weather" these two changes of health insurance carriers within a relatively short period of time, with all the attendant variability in some of the health insurance coverages and premiums.

### **Voluntary Health Insurance Enrollment**

The strength of the enrollment effort in the four communities is reflected in the relatively high proportion of residents enrolled in the voluntary health insurance plan in June 1953, the time of the study. Two-thirds of the 299 households reported had some health insurance for one or more persons in the household; about three-fifths of the 1,222 individuals in these households had such insurance.

The following analyses are based on data for male heads of the households only. It is probable that the impact of community organization on health insurance enrollment for male heads of households represents the situation generally for all individuals in the localities studied.

The prominent role of group affiliation as the basis for subscribing to voluntary health insurance was impressive. There were 270 male heads of households, and 154 (57 percent) had health insurance. More than 9 of every 10 were enrolled on a group basis. More than 3 of every 5 male heads of households who had health insurance were enrolled on a group basis in industrial plants and in other group employment situations.

The direct contribution of the Haywood County Community Development Program to health insurance can be measured by the data showing that about two-fifths of all enrolled male heads of households were enrolled on the group basis sponsored by that program.

Only about 1 in every 7 enrollees had subscribed as individuals. Proportions are cumulative to more than 100 percent because of a few cases of enrollment in two or more types of health insurance.

The effect of contributions of the community development program to voluntary health insurance enrollment was further demonstrated by the program's particular ability to enroll two groups usually less available to health insurance—farmers and low-income households. Of all farm operators enrolled,  $\frac{4}{5}$  of every 5 in 1953 had enrolled in the group plan sponsored by the Haywood County Community Development Program. Of the enrolled male heads of households who had annual net cash incomes of less than \$1,500,  $\frac{2}{3}$  of every 3 had enrolled with the community group program. Although health insurance enrollment among farmers and other workers in nongroup employment, as well as male heads of households with low incomes, was still relatively low in the four rural communities in the study, the community development program's particular success in enrolling many of them encourages further efforts.

## Conclusions

What do these data mean? What are the implications of this study? First, the results are sufficiently fruitful to indicate an area for further research. Several similar studies are necessary, however, before the results can be considered conclusive. The data in this single study appear to be sufficiently pointed to warrant consideration of possible action along three lines.

1. Voluntary health insurance carriers may need to reexamine their concept of "group." Groups of many kinds that do not charge dues or maintain membership rolls are found in communities. Such locality groups as neighborhoods and communities, when sufficiently organized, may be the means of reaching families living in open-country communities that are dependent upon agriculture for a livelihood, as well as other self-employed workers. Such a change in the concept of "group" may necessitate major alterations in many State laws and

administrative interpretations that relate to voluntary health insurance. In selecting personnel for selling and maintaining insurance in rural communities, carriers may need to consider this change in concept.

2. The implication of these data appears to be clear-cut for community leaders interested in health matters. Efforts in the direction of complete community organization, as contrasted with another special-interest group in health, appear to be fruitful for exploration. This seems to be a way of arriving at a "group" so as to take advantage of a group basis for voluntary health insurance. Also, this procedure opens channels of communication and uses social control techniques which are not possible under many other conditions. Through this procedure, some open-country families can be reached more adequately than through more specialized groups.

3. In training public health personnel, as well as personnel of other agencies functioning in rural areas, institutions may need to alter their training programs to include, or expand, community organization principles, procedures, and techniques. Professional personnel must give more attention to leadership training of lay persons for the assumption of communitywide responsibility. These agencies are in rural areas for the purpose of aiding rural people to raise their levels and standard of living. Health is generally recognized as one of the important aspects of levels and standards of living and many persons are of the opinion that voluntary health insurance is an important element in improving the health status of rural residents. It would appear that all agencies working in rural areas must in the future give more attention to community organization.

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# Continued High Incidence of Diphtheria in a Well-Immunized Community

By W. J. MURPHY, M.D., M.P.H., V. HAMILTON MALEY, M.D.,  
and LILLIAN DICK, B.S., R.N.

THE incidence of diphtheria in the United States has steadily declined during the past few decades. Morbidity and mortality have decreased in each of the various geographic areas, but not to a similar extent (1,2). The most abrupt drop has occurred in the Northeast, which prior to 1920 reported the highest rates in the country. In contrast, the most leisurely decline was observed in the South. At present, the rates reported from several of the southeastern States, including Georgia, are among the highest in the Nation.

Although evidence indicates that the abrupt drop in diphtheria morbidity during the past 25 years is related to the widespread use of active immunization, it is generally agreed that other factors have contributed to the decline. It is probable, too, that current variations in incidence in different areas may be due, in part, to factors unrelated to artificial immunization.

In an area of north Georgia comprising 10 counties with a combined population in 1950

of 156,175, the average annual morbidity rate for 1949-53 was 26.2 per 100,000 population as compared with a rate of 7.6 for the State. At the center of that area is Hall County, which reported an average annual rate of 47.8 during the same period. This report deals primarily with the diphtheria experience of Hall County.

Hall County, Ga., is located in the Piedmont Plateau of the foothills of the Appalachian Mountains and had a population of 40,113 in 1950, approximately 10 percent of which was Negro. Gainesville, the principal city, had a population of 11,936. On the whole, the county is prosperous and ranks in median family income among the upper 15 percent of Georgia's 159 counties.

Medical, public health, and hospital facilities are considered adequate. Since 1921, Hall County has had an organized health department with full-time professional personnel. Gainesville has a modern hospital with 114 beds. In 1953, there were 27 practicing physicians in the county.

## Diphtheria Incidence

From 1935 through 1953 no appreciable decline was observed in the diphtheria incidence in Hall County. This is shown in table 1 which compares the county's average annual morbidity and mortality rates with those for the State.

In view of the small Negro population in

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Only about 1 in every 7 enrollees had subscribed as individuals. Proportions are cumulative to more than 100 percent because of a few cases of enrollment in two or more types of health insurance.

The effect of contributions of the community development program to voluntary health insurance enrollment was further demonstrated by the program's particular ability to enroll two groups usually less available to health insurance—farmers and low-income households. Of all farm operators enrolled, 4 of every 5 in 1953 had enrolled in the group plan sponsored by the Haywood County Community Development Program. Of the enrolled male heads of households who had annual net cash incomes of less than \$1,500, 2 of every 3 had enrolled with the community group program. Although health insurance enrollment among farmers and other workers in nongroup employment, as well as male heads of households with low incomes, was still relatively low in the four rural communities in the study, the community development program's particular success in enrolling many of them encourages further efforts.

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1. Voluntary health insurance carriers may need to reexamine their concept of "group." Groups of many kinds that do not charge dues or maintain membership rolls are found in communities. Such locality groups as neighborhoods and communities, when sufficiently organized, may be the means of reaching families living in open-country communities that are dependent upon agriculture for a livelihood, as well as other self-employed workers. Such a change in the concept of "group" may necessitate major alterations in many State laws and

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3. In training public health personnel, as well as personnel of other agencies functioning in rural areas, institutions may need to alter their training programs to include, or expand, community organization principles, procedures, and techniques. Professional personnel must give more attention to leadership training of lay persons for the assumption of communitywide responsibility. These agencies are in rural areas for the purpose of aiding rural people to raise their levels and standard of living. Health is generally recognized as one of the important aspects of levels and standards of living and many persons are of the opinion that voluntary health insurance is an important element in improving the health status of rural residents. It would appear that all agencies working in rural areas must in the future give more attention to community organization.

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Table 2. Diphtheria cultures classified according to type, received from four areas of Georgia, October 1948-June 1954

Area	Total cultures	Gravis		Mitis	Minimus	Indeterminate
		Number	Percent	Number	Number	Number
Total for State.....	927	393	42.3	413	105	16
Hall County.....	169	154	91.1	14	0	1
Adjacent counties.....	70	48	68.6	17	2	3
Other counties in north Georgia.....	372	165	44.4	177	22	8
Counties in central and south Georgia.....	316	26	8.2	205	81	4

of the immediate family but not from the patient. In 12 of these instances, cultures were gravis in character and 1 was indeterminate.

#### Immunization Status

The immunization status of 96 diphtheria patients (1949-53) was obtained from their clinical records. Patients recorded as having received one or more doses of an immunizing agent were separated into two groups: (a) those who had received at least 3 doses of an antigen, the last one within 3 years of the date of illness; and (b) all others who had received at least 1 dose. The first were considered to represent immunization failures while in the second group protection was classed as inadequate or lapsed.

Information as to prior immunization was available for all but 14 of the 96 cases. The findings are summarized below.

Immunization	Number cases
None.....	48
Inadequate or lapsed.....	27
Immunization failure.....	7
Unknown.....	14

Of the 27 patients for whom immunization was recorded as being inadequate or lapsed, 5 had received one dose and 3 had received 2 doses of alum-precipitated toxoid within 3 years of the date of illness. For the remaining 19, there was an interval of more than 3 years between the date of the last inoculation and the onset of illness.

The 34 patients in the inoculated group in-

cluded 12 preschool and 22 children of school age, 7 boys and 27 girls. This apparent sex difference may be of some significance since a similar preponderance of cases among girls in inoculated groups has been reported by other workers (4).

In the unimmunized group there were 36 preschool and 10 school-age children and 2 adults above age 30. Of these 48 patients, 25 were males and 23 females.

Four of the 96 diphtheria patients died. None of the four had received an immunizing agent.

#### Active Immunization

In April 1953, a study was made of the extent to which active immunization was being employed in Hall County. For that purpose, a 10-percent sample of recorded live births during 1948-51 was obtained by selecting every 10th name from an alphabetical list prepared by the Georgia Division of Vital Statistics. The names appearing in the sample were checked against the records of the Hall County Health Department. Those not appearing in the files were checked against the records of three pediatricians. The remaining names that failed to appear in the physicians' records were arranged alphabetically, and a 20-percent sample was obtained by selecting every fifth name. The homes of the selected children were visited. If there was a history of prior immunization, the name of the physician administering the inoculations was obtained and his office was visited. A child was included in the

**Table 1. Average annual morbidity and mortality rates per 100,000 population for Hall County and for Georgia, 1935-53**

Years	Georgia		Hall County	
	Mor- bidity	Mor- tality	Mor- bidity	Mor- tality
1935-39-----	35.3	3.9	31.0	3.0
1940-44-----	18.4	1.7	35.6	1.7
1945-49-----	14.1	1.2	66.7	2.6
1950-53-----	6.4	.4	28.8	2.4

Hall County, the white and Negro rates are not considered separately. Until recently, the reported incidence of diphtheria in the white population was considerably above that for the Negroes. The rate for the white population has declined more rapidly, however, and since 1952 it has been slightly below the rate for Negroes.

The age distribution of diphtheria in Hall County does not differ appreciably from that of the State. At present in Georgia approximately 85 percent of all cases are reported in children below the age of 15 years, the highest rate being observed in the group 5 to 9 years old.

During the 5-year period 1949-53, diphtheria occurred in all sections of the county with relative frequency. Of the 96 cases reported for the period, 28 occurred in Gainesville and 68 in the remainder of the county. The average annual rates per 100,000 population for the 2 areas were 46.9 and 48.2, respectively. No undue concentration of cases was apparent in any particular occupational group. In keeping with the seasonal rise in incidence observed throughout the State, 50 percent of the cases were reported in October and November.

#### **Diagnostic Criteria**

To evaluate the criteria of diagnosis, we reviewed the records of the 96 cases of diphtheria reported during 1949-53. Primary consideration was given to: (a) the occurrence of a febrile illness of several days' duration; (b) evidence of a localized infection as indicated by a membrane in the throat, laryngeal involvement, or both; and (c) laboratory studies. In approximately four-fifths of the cases the local

and constitutional symptoms and the laboratory findings were consistent with a diagnosis of diphtheria. Some patients were described as having a febrile illness, sore throat, and a positive culture, but they lacked a typical membrane. In the remaining cases, the diagnosis was based on clinical grounds, characteristically on the appearance of the membrane. Apparently, the diagnostic criteria in Hall County were comparable to those in other areas of the State.

#### **Cultures**

Since October 1948 all virulent diphtheria cultures received by the central laboratory of the Georgia Department of Public Health have been forwarded for typing to the Laboratory Branch of the Communicable Disease Center, Public Health Service. And since July 1950 virulent cultures received by the branch laboratories have also been forwarded for typing.

A total of 927 virulent cultures were submitted for typing from October 1948 through June 1954. This figure represents the number of persons from whom cultures were received, and it includes only actual cases and intimate contacts.

The different types of *Corynebacterium diphtheriae* found in the various areas of the State are shown in table 2. The classification method is the one used by Frobisher (3). Gravis strains predominated in north Georgia, particularly in Hall and adjacent counties, but comprised only a small proportion of the cultures received from central and south Georgia.

The area designated as north Georgia represents approximately the northern two-fifths of the State. It includes 59 counties, 9 of which are contiguous with Hall County.

Of the cultures received from Hall County, approximately one-third were obtained from clinical cases and the remainder from household contacts. In numerous instances, unfortunately, cultures from hospitalized patients were not forwarded for typing to the Georgia Department of Public Health. Of the 96 cases reported during 1949-53, cultures were received from 55, and, of these, 52 were gravis and 3 were mitis. In 13 additional instances, cultures were received from one or more members

children in the South (5, 6), the proportion of Schick-negatives was also found to be high, even among those who had never received an immunizing agent. Similarly, in Schick surveys of young men entering the armed services (7, 8), the frequency of positives among men from the South has been lower than among those from most other areas of the country. In view of the findings in previous surveys, the results in Hall County are not surprising when considered in connection with the high diphtheria morbidity and the extent of artificial immunization.

### Discussion

The continued high incidence of diphtheria in Hall County is of interest in view of the general decline experienced throughout the Nation and in most areas of Georgia. Although it is conceivable that a variety of factors may have contributed to the Hall County experience, this study has been concerned primarily with the extent of active immunization, the prevailing strain of *Corynebacterium diphtheriae*, and the frequency with which clinical infections occurred among the immunized.

Hall County has had an organized health department for more than three decades and during most of that time immunization against diphtheria has been stressed by health officials and physicians alike. That the program has been reasonably successful in reaching a large proportion of the preschool population is indicated by the results obtained in checking a sample of live births against available immunization records. Although the estimates based on that sample cannot be readily compared with those reported from other areas in the past, immunization apparently has been used more extensively in Hall County than in numerous other localities (9-11), which have experienced a far lower incidence of diphtheria for a number of years. Obviously, the Hall County experience cannot be attributed solely to a lack of interest in active immunization. On the contrary, the incidence of diphtheria has continued at a high level despite a well-organized immunization program.

On the other hand, the evidence indicates that the use of a diphtheria antigen afforded

an appreciable degree of protection when recommended schedules were followed. In view of the proportion of children who had received an immunizing agent, 60 percent by the age 1 year and almost 100 percent by the age of 6 years, it is apparent that clinical infections were observed much less frequently among those who had received one or more inoculations. Moreover, of the infections observed in the inoculated group, the great majority occurred following inadequate dosage or after protection had been permitted to lapse.

It is possible that the high diphtheria incidence in Hall County may be associated with an unusually aggressive strain of *C. diphtheriae*. Since October 1948, when routine typing was begun, more than 90 percent of the cultures from that county and almost 70 percent of the cultures from neighboring counties have been gravis strains. The findings are in sharp contrast to the diphtheria flora usually encountered in other areas of the United States (12-14). Moreover, the serologic studies reported by Hermann and Parsons (15) indicate that the gravis strains isolated in north Georgia are closely related antigenically.

However, the clinical manifestations of the disease have not been unusual and case fatality rates have not been excessive, even among the unimmunized.

The association of a gravis strain with the continued high incidence of diphtheria in Hall County is not necessarily peculiar to that type of *C. diphtheriae*. Presumably, other types might be involved elsewhere in similar situations.

### Summary

From 1935 through 1953, the incidence of diphtheria in Hall County failed to decline in spite of a well-organized immunization program.

A study based on a sample of live births indicates that at least 60 percent of the infants born in the county receive an immunizing agent by the age of 1 year. By the age of 6 years, the figure approaches 100 percent.

A review of the diphtheria cases reported during the period 1949-53 indicates that active immunization afforded an appreciable degree

inoculated group only if an immunization record was on file. Those who had moved from the county were considered unimmunized. Infants who had died prior to the study were not excluded from the tabulations.

The 10-percent sample of live births for the period, 1948-51, included 395 names. The records of the Hall County Health Department and those of three pediatricians showed that 239 had received one or more doses of a diphtheria antigen. In 192 instances, the inoculations had been given during the first year of life. Since a considerable period of time is required in administering multiple doses of an antigen, the date of the first inoculation was used.

For the most part, a combined diphtheria-tetanus-pertussis antigen had been administered, although during 1948 and 1949, the primary series sometimes consisted of 2 doses of alum-precipitated toxoid. Of the 239 infants for whom immunization records were on file, 184 had received at least 3 doses of a combined antigen; 37 had received 2 doses of an antigen, chiefly alum-precipitated toxoid, and 18 had received only 1 dose.

There remained 156 names which did not appear among the immunization records. As stated previously, a 20-percent sample was obtained, and the 31 children in the sample were visited. A history of prior immunization was obtained for 12 children and verified by a visit to the physician's office. Of this group, 9 had been inoculated during the first year of life. For 12 children, there was no history of prior immunization and 7 families had moved from the county.

The proportion of Hall County children born during 1948-51 who had received an immunizing agent during the first year of life was estimated as:

$$\frac{192 + (5 \times 9)}{395} = 60 \text{ percent.}$$

The estimates of 68.3 percent for the second and 74.4 percent for the third year of life were similarly prepared.

The inoculated group included only children with immunization records, and since infants who died were not excluded and those who had moved from the county were considered un-

immunized, the actual immunization rate probably exceeded the estimated figures.

By the age of 6 years, the proportion of inoculated children in Hall County approached 100 percent. Prior immunization against diphtheria is a requirement for entrance to school, and although the regulation is not rigidly enforced, comparatively few children fail to comply with it. It is also routine practice for representatives of the health department to visit the schools in the fall and to administer recall doses to those in the lower grades who have not received one within 3 years.

### Schick Tests

In December 1953, the children in 1 Negro and 2 white schools were Schick tested. The test group included 1,838 children ranging in age from 6 to 18 years. Both urban and rural areas were represented. Tests were made by injecting intradermally into the forearm 0.1 cc. of an appropriate dilution of a standard diphtheria toxin. Control tests were not employed. Readings were made on the sixth day and doubtful reactions were read as positive. Since the findings in each school group did not differ appreciably, they were considered together (table 3).

Even assuming some margin of error in connection with the technique employed, it is apparent that comparatively few school children in Hall County are Schick positive. This obviously implies an unusual immunization rate, either natural or artificial, or both.

In a number of previous surveys of school

**Table 3. Number and percent of positive Schick tests by age, Hall County, Ga., December 1953**

Age (years)	Number tests	Number positive	Percent positive
All ages	1,838	106	5.7
6-7	412	27	6.5
8-9	351	16	4.5
10-11	379	20	5.2
12-13	316	18	5.6
14-15	227	17	7.4
16-18	153	8	5.2

*Questions put to homemakers in Rochester and Syracuse, N. Y., evoke a striking relation between knowing and doing.*

# Nutritional Knowledge and Practices

By CHARLOTTE M. YOUNG, Ph.D., KATHLEEN BERRESFORD, M.S.,  
and BETTY GREER WALDNER, M.N.S.

WHY are some people less well fed than they might be, even when their income is sufficient? A study in New York State demonstrated that in a number of families where there were dietary inadequacies lack of income was not the primary cause (1). May one explanation be that homemakers do not know what to feed their families to provide a nutritionally adequate diet? Studies in Richmond, Va., in 1947 indicated that adequacy of family feeding might be related to the level of homemakers' knowledge about food and nutrition (2).

Public health workers, teachers, extension workers, and school lunch managers are interested in determining what knowledge about food and nutrition the homemaker applies to feeding her family. On what nutrition subjects have we succeeded in educating the homemaker? Where do we need to do better? What problems do homemakers have in planning, buying, or preparing food for their families? Do they seek help with these problems? What kinds of help? Where has the homemaker obtained her present information on food and nutrition?

In an attempt to answer some of these questions, we studied the food and nutrition knowl-

edge and practices of cross-sectional representative samples of homemakers in two upstate New York cities, Rochester and Syracuse, in the early fall of 1953.

## Survey Techniques

Data were collected by trained interviewers directly from homemakers, that is, persons responsible for planning family meals. The interview used pretested open-end questions. The interviewer recorded responses as nearly as possible in the homemaker's words. Ninety-six questions were asked. An average interview lasted 1 hour.

Sampling was directed by P. J. McCarthy, director of the Cornell University Statistics Center, Ithaca, N. Y. Within the city limits of Rochester, population 332,488, and Syracuse, population 220,583 (1950), sample blocks were drawn with probability proportionate to size, based on the census of housing block statistics for 1950. All private dwelling units in the sample blocks were listed, and those to be interviewed were selected by a field supervisor in a central office in accordance with a scheduled sample interval starting with a random number. Validation of the samples by comparison with statistics from the 1950 census is reported in detail elsewhere (3). The educational attainment level of the homemakers in the Syracuse sample was somewhat higher than that of Syracuse women reported in the 1950 census. No single-person dwellings were used.

Completed interviews in Rochester numbered

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of protection. Of the cases observed among previously inoculated children, the great majority occurred following inadequate dosage or after protection had been permitted to lapse.

Since October 1948, more than 90 percent of the cultures received from Hall County have been gravis strains. In central and south Georgia gravis strains were encountered infrequently.

The clinical manifestations of the disease in Hall County have not been unusual.

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### Warns Against Hoxsey Treatment

An official public warning against use of the Hoxsey treatment for internal cancer was issued April 4, 1956, by the Food and Drug Administration.

The warning was based on the finding by the United States Court of Appeals for the Fifth Circuit that the treatment was worthless. Analysis of the contents of the liquids and pills issued by the Hoxsey clinics at Dallas, Tex., and Portage, Pa., showed no value in the cure of cancer and that they contained potassium iodide, a compound which has been indicated as one that may accelerate growth of some cancers. In addition, the Food and Drug Administration, despite a thorough study, stated it had not found a single-verified cure of internal cancer effected by the Hoxsey treatment.

An injunction obtained October 26, 1953, prohibits the shipment of Hoxsey "medicines" in interstate commerce if the labeling represents, suggests, or implies that they are effective in the treatment of any type of internal cancer.



could not do so for any group, "no knowledge"; and those in between, "some knowledge."

The conventional foods, such as meat or meat substitutes and potatoes and other vegetables and fruits, were mentioned for inclusion in meals by almost all of the homemakers. Only a few in the study mentioned items more likely based on nutritional knowledge than custom.

None of the homemakers mentioned all 7 of the basic food groups; only 3 percent named 6 of them; an additional 12 to 14 percent, 5. The great majority mentioned only 3 or 4 groups.

Only one-third to one-half of all the homemakers had enough knowledge to give correct reasons for inclusion of any of the food groups. Again meat or meat substitutes, potatoes and other vegetables and fruits, and the milk group were best known. Only 3 to 6 percent of the homemakers knew a reason for including vitamin C-rich fruits; 7 to 10 percent, carotene-rich fruits and vegetables; 4 percent, butter or fortified margarine; 16 to 19 percent, bread, flour, or cereals.

Assessment of nutritional knowledge was based on the number of food groups for which each homemaker could give a correct reason for inclusion in her family's meals. Nineteen percent of the Rochester and 30 percent of the Syracuse homemakers gave evidence of an adequate knowledge as defined in this study; 32 and 36 percent, some knowledge; 34 and 49 percent, no knowledge.

Approximately one-fourth of the homemakers in both cities defined a balanced diet in such a way as to show the expression was meaningful to them. Two-thirds to three-fourths of the homemakers said they had never heard of the basic seven. Only 10 to 20 percent who had heard of the term could name at least one of these food groups.

The percentage of homemakers in each city who could name possible nutritional substitutes for each of three basic foods is shown in table 2. Again, the meat group was best known.

The younger and better educated homemakers definitely displayed more knowledge of nutrition than the older and less well educated. Since age and educational level proved to be closely associated, it was felt that educational

level was the determining factor. There was no consistent relationship between family income level and the homemaker's knowledge of nutrition. What income influence appeared to be present was found to be due largely to educational differences. This finding occurred when the income and educational influences were segregated by two-way tabulation for any given measure of nutritional knowledge. Details of these relationships and supporting data are reported elsewhere (4).

In Rochester there were 35 percent and in Syracuse 40 percent of the homemakers who reported they had "studied about what to eat." Most of them had studied the subject in public school. Only a few reported study under other circumstances such as courses offered by the Red Cross, home bureau, and cooking schools. Regardless of which measure of nutritional knowledge was used, a higher percentage of homemakers who had studied about what to eat had some knowledge of nutrition which was lacking in those who had not studied.

Performance

In relating the performance of the homemaker in feeding her family to her knowledge of nutrition, we considered: (a) recall by the homemaker of foods served her family in the previous 24 hours and whether or not the meals had been typical; (b) recall of beverages (separately for children and adults) served at each meal; and (c) quantitative information obtained by the homemaker's recall of the amounts of certain key foods used during the previous week.

Family income and age and education of the homemaker were related to performance, and nutritional knowledge was related to performance on a group basis. The practices of home-

Table 2. Percentages of homemakers with knowledge of correct nutritional substitutes for three basic foods

Basic food	Rochester	Syracuse
Meat, fish, or poultry-----	61	63
Milk-----	35	44
Citrus fruit-----	28	35

**Table 1. Percentages of homemakers who named and understood why given foods should be served with each meal, and percentages using such groups in the previous 24 hours**

Basic food groups	Naming as necessary meal components		Giving reason for inclusion		Using in past 24 hours	
	Rochester	Syracuse	Rochester	Syracuse	Rochester	Syracuse
Meat, fish, poultry, etc.....	97	96	36	50	99	99
Potato, other vegetables and fruits.....	96	95	34	46	92	93
Milk, cheese, ice cream.....	68	58	31	32	82	87
Bread, flour, cereals.....	55	52	16	19	99	99
Leafy, green, or yellow vegetables.....	13	17	7	10	65	60
Butter or fortified margarine.....	12	13	4	4	78	74
Citrus fruit, tomato, cabbage.....	9	9	3	6	72	71

331 and in Syracuse, 315, representing in each city 63 percent of the sample drawn. The disposition of the rest of the sample drawn included 12-percent refusals in Syracuse and 14 percent in Rochester. The most frequent reasons given for refusals were "not interested," or "too busy," but they also included serious illnesses or recent deaths in the families, inability to speak English, apparent mental incompetency, and refusal to answer the door. The remaining 25 and 23 percent of the sample drawn were accounted for almost equally by single person dwellings and by families not at home on at least three interview attempts at different times of the day and evening.

Responses to various parts of the questionnaire were tabulated and related to the following factors: age group of the homemaker, her level of formal educational attainment, whether or not she had ever "studied about what to eat," and family income level. The age groups used included the following: young (under 40 years of age), middle-aged (40 to 60), and older (over 60). Homemakers were grouped in three levels of educational attainment—those who had not attended high school, those who had attended but not completed high school, and high school graduates. Divisions used for family income level were under \$3,500, \$3,500–\$4,999, and \$5,000 or over.

The homemaker's knowledge was assessed according to her response to a number of questions. Among others these included:

1. What do you feel should be included in the meals for your family each day? Why do you feel (name of food) should be included? Why does your family need that?

2. Maybe you have heard or read about a so-called balanced diet. What does a balanced diet mean to you?

3. Do you know what is meant by the "basic seven"? What are the groups in the "basic seven"?

4. What other foods could be used in place of milk? When you do not wish to serve meat, fish, or poultry, what foods do you think you can serve in their place and get some of the same food value? When you do not have oranges or grapefruit is there anything you can serve that would give you about the same food values? What?

### Nutritional Knowledge

Response to the question of what should be included in the family's meals each day is shown in table 1. If a homemaker named an important nutrient contribution or nutritional function served by the food group mentioned, the interviewer credited her with giving a correct reason. For example, in answer to questions about why meat and milk should be served each day, typical correct replies might include:

Meat—"because it has lots of iron" or "because it builds good red blood" or "protein" or "because it builds muscle."

Milk—"for strong bones and teeth" or "because it has lots of calcium."

In contrast, replies such as "good for you," "to grow," "because we like it," or "need it" were not interpreted as indicating specific nutritional knowledge. Those who could give a correct reason for three or more groups were said to have "adequate knowledge"; those who

Differences were evident in the groups where knowledge might be expected to be causative. Of homemakers who had an adequate knowledge of nutrition, those who used all seven of the basic food groups in their meals were a far greater proportion (48 percent) than of those with no knowledge (31 percent). Also, more homemakers with an adequate knowledge (76 percent) served nutritionally good breakfasts than did those with some or no knowledge (62 and 51 percent, respectively).

Knowledge of nutrition appeared to be re-

lated to performance as measured in more quantitative terms also (table 5). There was a smaller percentage of homemakers with an adequate knowledge of nutrition in the category of those using less than 50 percent of their families' suggested needs for milk and citrus fruit.

### Food Problems and Help Sources

The details on information obtained concerning the planning, buying, and preparation of

**Table 4. Percentages of homemakers in each category of nutritional knowledge using given food groups in previous 24 hours**

Food group	Rochester			Syracuse		
	Level of knowledge					
	None	Some	Adequate	None	Some	Adequate
Meat, fish, poultry.....	98	99	100	100	97	100
Potato, other vegetables and fruits.....	89	93	97	92	91	96
Milk, cheese, ice cream.....	71	88	95	82	90	89
Bread, flour, cereal.....	99	99	100	99	100	100
Butter, fortified margarine.....	93	93	98	97	99	97
Leafy, green or yellow vegetables.....	62	65	71	61	55	66
Citrus fruit, tomato, cabbage.....	69	74	78	59	75	81

**Table 5. Percentages of homemakers in each category of nutritional knowledge using adequate quantities of three given food groups during week**

Food groups and adequacy levels	Rochester			Syracuse		
	Level of knowledge					
	None	Some	Adequate	None	Some	Adequate
<i>Milk</i>						
Less than 50 percent of need <sup>1</sup> -----	27	15	14	21	21	14
At least 90 percent of need <sup>1</sup> -----	30	41	35	37	27	30
<i>Meat</i>						
Two pounds per week per person over 10 years of age and one pound per week per child under 10 years of age-----	85	90	86	84	87	96
<i>Citrus fruit</i>						
Less than 50 percent of need <sup>2</sup> -----	25	24	8	27	22	15
At least 90 percent of need <sup>2</sup> -----	46	51	71	41	41	52

<sup>1</sup> Based on 1 pint per day per adult; 1 quart per day per child.

<sup>2</sup> Based on 1 serving citrus fruit or equivalent per day per person.

makers with little or no nutritional knowledge were compared with those who had adequate knowledge.

The performance of the homemaker in feeding her family was considerably better than her knowledge (table 1). Homemakers who actually used each food group were more numerous than those who mentioned that it should be included in the meals or those who knew why. However, the food groups that were least well known were also least used. It would seem likely that for those groups where knowledge is necessary to appreciate the need for their inclusion in the family meals, inclusion in the 24-hour period was a matter of chance. Certain food groups, such as meat or meat substitutes, potatoes and other vegetables and fruits, and bread, flour, or cereals, are included in most meals conventionally. Probably butter (or fortified margarine) was used more than the figures indicate. Its use may not have been recalled. The figures presented for food usage in the previous 24 hours are almost identical, with minor variations, to those obtained in urban and rural Virginia and in two rural school districts in New York (2, 5).

Approximately 40 percent of both the Rochester and Syracuse homemakers included all seven food groups in their menus. This figure is lower than the 50 percent reported for urban Virginia (2) but similar to those reported for rural Virginia and rural New York (5).

Milk was the usual beverage served at most meals for children. But in substantially all of the homes, it was not the usual beverage for adults at any meal. Only 13 percent reported it as one of the adult beverage choices at breakfast, 33 to 44 percent at noon, and 31 percent at night.

A quantitative estimate of the adequacy of feeding practices with respect to four food groups is presented in table 3, with the bases used in evaluation of adequacy. In about one-fifth of the homes, less than half the suggested quantitative needs of the family were met for both the milk and citrus fruit groups. Again, practice is shown to be best with regard to usage of the meat and meat substitutes group.

Feeding practices did not vary so much with age and education as did levels of nutritional

**Table 3. Percentages of households using adequate quantities of four given food groups during week**

Food groups and adequacy levels	Rochester	Syracuse
<i>Milk</i>		
Less than 50 percent of need <sup>1</sup> -----	20	19
At least 90 percent of need <sup>1</sup> -----	34	31
<i>Eggs</i>		
One per day per person-----	39	33
Three or more per week per person--	98	98
<i>Meat, fish, or poultry</i>		
Two pounds per week per person over 10 years of age and one pound per week per child under 10 years of age-----	91	88
<i>Citrus fruit, tomato, or juices</i>		
Less than 50 percent of need <sup>2</sup> -----	21	20
At least 90 percent of need <sup>2</sup> -----	51	44

<sup>1</sup> Based on 1 pint per day per adult; 1 quart per day per child.

<sup>2</sup> Based on 1 serving of citrus fruit, or equivalent, per day per person.

knowledge. However, the younger and more educated homemakers adhered to better practices than did others. The level of educational attainment of those under study appeared to be the factor which was most consistently related to adequacy of performance in feeding the family. Income effects, as was true for their relationship with knowledge, were considerably less consistent and of smaller magnitude (6). Homemakers who reportedly had studied about what to eat apparently served better meals, both qualitatively and quantitatively, to their families than those who had not studied. The quality of breakfast patterns also improved with the factors which affected other feeding practices (6).

### Knowledge and Action

Adequacy of dietary practices appeared to be related directly to the level of the homemaker's nutritional knowledge. As knowledge increased, so did the percentage of homemakers who included certain basic food groups in the 24-hour period (table 4), though differences were not large.

# Repeated Pregnancy Wastage

By F. J. SCHOENECK, M.D.

**P**RECONCEPTIONAL study, treatment, and other medical attention for women whose pregnancies repeatedly end in misfortune have been accepted as a hope of reducing pregnancy wastage.

I have previously reported that a relatively small group of childbearing women account for a disproportionately high percentage of such wastage (1). Schlesinger and Allaway (2) state that the expectation of perinatal loss among women with a history of previous child loss was 2.7 times greater than among multiparous women without such loss. They concluded: "This trend toward further narrowing of the problem of perinatal loss points to the need for increased concentration of research and public health services on the vulnerable group of women who present a history of previous child loss." Randall, and associates (3) state: "When all other factors were disregarded and the outcome of the present pregnancy was compared among women with good obstetrical history and those with poor obstetrical history, abortion was found to have occurred 20 times more frequently when the previous obstetrical history was 'poor'."

Other articles of the general nature of those quoted are appearing in medical literature. The Syracuse Department of Health is reporting here the pregnancy outcomes of a group of

women selected specifically because of their poor obstetrical histories.

## Pregnancy Outcomes

Clinical histories of these women have been gathered in the past 2 years from sources in and around Syracuse, N. Y. These sources included private records, completed prenatal clinic records, and histories obtained by public health nurses in patient interviews in connection with the department's current survey of pregnancy outcomes. The histories were collected primarily as "matching controls" to compare with the histories of patients attending our local prepregnancy treatment clinic.

The material consists of the obstetrical histories of 135 patients who had completed 653 pregnancies (an average of 4.8 pregnancies per patient). There were 3 sets of twins among the 135 patients; 126 (93.3 percent) were white and 9 (6.6 percent) were Negro; 75 (55.5 percent) were private patients, and 60 (44.5 percent) were service cases. Four patients, (2.9 percent) had definite Rh problems.

Outcomes of 653 pregnancies, according to the histories of these 135 patients, were:

	Number	Percent
Living babies.....	201	30.8
Term.....	141	21.6
Premature.....	60	9.2
Unsuccessful pregnancies.....	452	69.2
Postnatal deaths:		
Term.....	8	1.2
Premature.....	64	9.8
Stillborn.....	49	7.5
Abortions.....	324	49.6
Ectopic pregnancy.....	7	1.1

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*Dr. Schoeneck is the director of the bureau of maternal hygiene, Department of Health, Syracuse, N. Y.*

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food by homemakers are not reported here. However, it was found that family food shopping is done chiefly by homemakers, usually once a week. Most homemakers do not plan meals much ahead of time. More than 40 per cent do their planning on the day of the planned meal or at the "last moment." About two-thirds of the homemakers said they had a specific amount of money to spend for food each week or month. Ninety-two per cent of the homemakers felt their families were getting all the needed foods.

One-third of the homemakers said they encountered some difficulty in planning, buying, or preparing food for their families. Two-thirds of those who said they had problems desired help. Means of obtaining variety and planning to suit all of the family's needs were mentioned most frequently. Budgeting, quick menus, food habits, and special diets also were cited as problems in the order named. Younger, better educated homemakers expressed the need for help with more problems than did others.

The homemaker ranked magazines and newspapers as the primary source for information on what to feed the family. Mothers and relatives were the persons most often mentioned as sources. Of professional persons, the greatest number of homemakers felt the physician had given them the most information. Homemakers used recipes and information on food preparation more extensively than other kinds of material supplied. Next most frequently used was information on meal planning and the components of a balanced diet.

Results of the study have been reported to public health, nutrition, education, and extension groups in Rochester, Syracuse, and elsewhere. These have included regional public health and dietetic associations; nutrition committees; nutrition workshops for health, education, and welfare personnel; and workshops for school lunch personnel, for home economics teachers, and for extension workers.

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# Cancer in Iowa

Of each 100,000 Iowa residents, 509 persons had cancer during 1950; 347 of these were first diagnosed during the year. Females had a slightly higher incidence rate than males. When adjustments are made for the age distribution of the population, the Iowa incidence rate for all sites excluding skin, 253, was 12 and 9 percent below the respective figures for the combined 10 cities (286) and the 4 northern cities (277) recently surveyed by the National Cancer Institute of the Public Health Service. Much of this differential can be attributed to a lower rate in rural Iowa. The rate for urban Iowa agreed well with that reported for the four northern cities.

In Iowa, 76 percent of the newly diagnosed cancer cases were confirmed microscopically. This was essentially the same as the combined figure from surveys of the 10 urban areas. The urban-rural differential in this respect was small—77 percent contrasted to 73 percent—which suggested about equal reliability of diagnoses in the two population groups. In view of the proportion of cases with microscopic confirmation in Iowa, it may be noted that most comparisons and inferences drawn from the Iowa data remained essentially unchanged, whether based on total newly diagnosed cases or solely on those meeting exacting diagnostic criteria.

Among Iowa males, cancer occurred most frequently in the digestive system, skin, genital organs, buccal cavity, and respiratory system. Among females, the order was genital organs, breast, digestive system, and skin. The leading specific sites for males were prostate, stomach, large intestine, and lung; for females, breast, cervix, and large intestine.

Incidence rates in the urban population were higher than in the rural population for such primary sites as lung, larynx, and cervix. Several lines of indirect evidence, based partly

on examination of the data for internal consistency, support the hypothesis that these differences are real. There was little difference in the incidence of cancer of the corpus uteri, breast, prostate, and digestive system among urban and rural residents.



Public Health

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No. 37

The accompanying summary covers the principal findings presented in Public Health Monograph No. 37, published concurrently with this issue of Public Health Reports. The authors are with the National Cancer Institute, National Institutes of Health, Public Health Service, Bethesda, Md., and the Iowa State Department of Health, Des Moines, Iowa.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

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Haenszel, William, Marcus, Samuel C., and Zimmerer, Edmund G.: Cancer morbidity in urban and rural Iowa. Public Health Monograph No. 37 (Public Health Service Publication No. 462). 85 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956. Price 20 cents.

Of the total of 653 pregnancies, 12 babies (1.8 percent) had congenital anomalies. Of 201 living children, 3 (1.4 percent) had retro-lental fibroplasia.

Unfortunately, the information available is not sufficiently complete to allow epidemiological analysis. Such an approach to each patient might establish whether these women have more in common than their obstetrical history. Identification of such common factors is a step toward their elimination or control.

There is some question in our minds about the complete reliability of the retrospective observations of these women, but we are gathering data from our continuing study which we hope will provide clues for further preventive and remedial action.

Reduction in infant loss and salvage of babies from unusual pregnancies have certainly not kept pace with the reduction in maternal mortalities. Pregnancy salvage for the minority of unsuccessful patients is a challenge to the public health-obstetric-pediatric team.

### Comments

We subscribe to the current methods of correction as exemplified by the present programs in New York City, Chicago, and New York State, outlined by Yankauer (4) and by various other professional groups and health agencies. In general these programs aim at improving care during the prenatal, labor, and delivery periods, and pediatric care.

Our previous studies in the field of unsuccessful pregnancies would seem to indicate that fetal salvage is essentially an obstetrical problem (5). Hughes (6) in speaking of fetal salvage states: "Although we believe that all these standards should be carried out carefully; that prenatal care should be improved; that pediatric care after birth should be made bet-

ter, we are of the opinion that in order to reduce the infant death rate to a new low in this country, we must take a more specific approach to the problem."

One example of a specific approach is the preconceptional study and prophylactic treatment of women with a history of repeated unsuccessful pregnancies, as carried out by Hughes and his group in Syracuse. Many other types of study are necessary to cope with the obstetrical complications so often associated with abortion or fetal loss.

Public health activities can play important roles in such a program. As an example, in Syracuse we are trying to find women who have or probably will have unsuccessful obstetrical experiences so that they may be studied and perhaps helped to bear healthy babies.

Women with habitual pregnancy loss should be recognized as having specific problems worthy of consideration from all interested medical groups.

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Does the nitrification of soil contribute to methemoglobinemia, one cause of infant mortality? A survey of soil and water in southern Minnesota explored the possible relationship.

# Soil Nitrification and Nitrates in Waters

By EDWIN L. SCHMIDT, Ph.D.

VERY young infants, usually less than 2 months old, may acquire methemoglobinemia as a result of ingesting water high in nitrates. The ingested nitrate may oxidize a portion of the hemoglobin to methemoglobin with consequent loss in oxygen transport and oxygen exchange in the blood; if severe, the anoxemia may produce serious effects, and death may occur.

Cases of methemoglobinemia induced by well waters high in nitrates have been reported principally in the midwestern United States and the central Provinces of Canada (1, 2). Although the high nitrate content of most of the wells studied apparently was associated with nearby sources of pollution, the origin of the nitrates that accumulate in ground waters was not always clear (2). Several writers have suggested that nitrate formation in normal agricultural soils may contribute significantly to nitrate accumulation in rural well waters (1, 3-5). This suggestion merits further consideration, since the peculiar geographic distribution of the disease in the United States corresponds roughly to the belt of highly productive Chernozem and Prairie soils.

Nitrates are found in soils as a result of the activities of the soil microflora. Nitrogen reaches the soils principally in organic form as

a part of plant and animal residues, and in this form it is subject to attack by a large and diversified group of soil micro-organisms. As the result of microbial action the nitrogen added originally in organic complexes is transformed into new organic combination as a constituent of microbial protoplasts, and the excess beyond cell needs is converted to the inorganic ammonium form. A first prerequisite of high nitrate production is the occurrence of nitrogen in the ammonium form.

Ammonium nitrogen is transformed rather rapidly under appropriate soil conditions by the activity of the specific autotrophic nitrifying bacteria of the genera *Nitrosomonas* and *Nitrobacter*. These organisms derive their energy, respectively, from the oxidation of ammonium to nitrite and the oxidation of nitrite to nitrate. Many soil factors influence the activity of the nitrifiers, but it is well established that the most fertile soils generally promote the most active nitrification.

To obtain information regarding the possible relationship between nitrate accumulation in waters and nitrate production in soils associated with those waters, a survey of soil nitrification was undertaken in the methemoglobinemia region of Minnesota in 1951. This survey was made possible by a grant from the Minnesota Department of Health.

## Organization of the Survey

The areas included in the survey were located in Renville, Nobles, Rock, and Mower Counties

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Excluding cancers of the lymphatic tissue and the hematopoietic system, two-thirds of the newly diagnosed cancers were localized at time of diagnosis. One of four had spread to adjacent tissue or regional lymph nodes, and 1 of 10 had metastasized to remote tissues. More cancers in males were diagnosed while localized (71 percent, excluding lymphatic tissue and hematopoietic system) than in females (63 percent). This resulted not from a systematic sex differential for certain sites but from the preponderance of breast cancer among women, for which the probability of early diagnosis has been relatively poor. The greatest variable in stage at diagnosis was shown with regard to primary site. To illustrate, only 49 percent of cancers involving the digestive system were diagnosed while localized compared to 86 percent for buccal cavity. In general, the proportion of localized cases was higher for the more accessible sites.

Of every 100 residents with newly diagnosed cancer in Iowa, 75 were alive 6 months after diagnosis, and 66 were still alive after 1 year. There was no difference in the urban and rural experience with respect to survival. Stage at diagnosis had the most pronounced effect on survival rates. Of cancer cases diagnosed while localized, 81 percent survived 12 months as contrasted to 45 percent of those with regional involvement and 27 percent, with remote metastasis. Uterus and large intestine are among the sites exhibiting the greatest range in survival rates for cases in early and late stages. Survival rates for certain sites, such as pancreas and lung, are extremely poor even when diagnosed early.

With respect to primary site of cancer, agreement between data on medical records and on death certificates was good. For most primary sites, comparisons between urban and rural areas based on incidence and mortality rates were in close agreement.

Morbidity data reported from Denmark generally show findings similar to those from Iowa with respect to urban-rural differentials. Both showed substantial differentials in incidence for all sites combined (exclusive of skin, lymphatic tissue, and hematopoietic system). For lung and bronchus, both sets of data exhibited a much more pronounced urban-rural differen-

tial among males. They agreed on two distinct urban-rural patterns for cervix and corpus uteri. Neither the Danish nor Iowa data supported impressions of higher skin cancer incidence rates among rural populations as reported in medical textbooks.

The age and sex patterns of cancer incidence in Iowa conformed generally to those reported from morbidity surveys elsewhere. Incidence of cancer increased rapidly during late adult life for both sexes. Although female rates for all ages combined exceeded those for males, females experienced lower rates at ages under 10 and over 65.

Although most cancers tend to appear in late adult life, some forms occur relatively frequently among young people. Less than 5 percent of the newly diagnosed cases in Iowa occurred among persons under 35, whereas one-fourth of cancers of the brain and endocrine glands, not elsewhere classified, and one-fifth of those in the skeleton and hematopoietic system were in this age group.

Carcinoma constituted 86 percent of the newly diagnosed, microscopically confirmed cases of cancer in Iowa, a figure in close agreement with that from the 10-city morbidity surveys. Within Iowa there was no difference in this respect between urban and rural residents. Adenocarcinoma was more frequent among females, whereas epidermoid carcinoma was the leading type among males. One site—breast—accounted for much of the preponderance of adenocarcinomas among females. Leukemia was the most frequent histological type encountered at ages under 15. Thereafter, carcinomas became increasingly predominant.

During 1950, 6,979 cancer patients were hospitalized for a total of 159,316 days, an average of 23 days per patient. The average length of stay did not differ for patients from urban and rural areas. Cancers of the digestive system alone accounted for about one-third of the total hospital days. Of the newly diagnosed resident cases, 59.2 percent were hospitalized within 1 year after diagnosis. The first course of hospitalization for newly diagnosed cases accounted roughly for three-fifths of the total hospital days devoted to cancer treatment. The average duration of first hospitalization was 20 days.

considered in connection with certain conditions at the time of sampling. The first sampling in Renville County, in early July, followed a period of about 3 weeks of abnormally heavy rainfall. The excess rainfall had caused standing water in some fields, drowned-out areas in corn, alfalfa, and bean fields, and a water table within 30 inches of the surface in many places. At the time of the second sampling, late in August, more normal conditions of rainfall prevailed. Both rainfall and crop development conditions were altered markedly between sampling periods. The nitrate content of the water supplies was lower and that of the surface soils was higher at the time of the second sampling. It is likely that the high rainfall prior to the initial sampling leached large quantities of nitrates from the surface soil at a stage of crop development that made relatively small nutritional demands on the nitrates of the soil. Much of the nitrate washed from the surface soil might well have contributed to that of the ground water supply.

Similar variations with rainfall conditions were observed in Rock and Nobles Counties, although the nitrate concentrations fluctuated less. In these counties, initial samples were taken after several weeks of near normal weather, whereas the second samples were taken soon after a short period of heavy rainfall. The variation noted in the nitrate content of the same well water is in agreement with the observations of Siemens and Mallett (9).

The data concerning the relationship between the nitrifying capacity of the soils and the nitrate concentration of the water supplies near those soils are summarized in table 4. The water supplies are grouped according to their nitrate content.

Soils that were obviously contaminated with organic nitrogen by livestock had the highest nitrifying capacities. These soils represented barnyards or the feeding lots so common in southwestern Minnesota or areas that so closely adjoined them as to be influenced by the organic nitrogen present. As can be seen in table

Table 1. Nitrate content of water supplies and of nearby soils in Renville County, Minn.

Site	Water supply	Date sampled in 1951	NO <sub>3</sub> N in water (p.p.m.)	NO <sub>3</sub> N in soils within 50 feet of water supply (p.p.m.)	
				Surface	Subsoil
1	Farm well A	July 9	120	6	23
		Aug. 23	92	212	( <sup>2</sup> )
	Farm well B	July 9	54	7	19
		Aug. 23	29		
2	Field tile	July 9	18	12	6
		Aug. 23	4	13	5
3	Farm well	July 10	75	44	14
		July 10	10	8	15
4	Farm well	July 10	12	10	2
		Aug. 23	6	29	3
		July 10	87	4	2
		Aug. 24	46	67	
5	Pasture well	July 10	( <sup>1</sup> )	6	2
		Aug. 24	1.0	11	58
		July 10	35	18	4
		Aug. 24	8	69	7
6	Farm well	July 10	9	10	12
		July 10	1.0	2	2
7	School well	Aug. 24	1.0	8	5
		July 11	70	16	2
8	Farm well A	Aug. 24	16	45	7
		July 11	4.0		
	Farm well B	Aug. 24	1.0		
		Aug. 24	8	71	11
26	Farm well	Aug. 24	1.0	16	5
27	Farm well	Aug. 24	1.0		

<sup>1</sup> Under construction. <sup>2</sup> Lost.

of southwestern and south central Minnesota. The first three of these are among the counties in the State that reported the largest number of methemoglobinemia cases in the period 1947-49, according to the report of Rosenfield and Huston (5). Mower County is about 100 miles east of the principal methemoglobinemia region described in that report.

Starting points for studies in each county were selected on the basis of records on file at the Minnesota Department of Health. Each initial site was a farm that, according to the health department's field studies of infant methemoglobinemia, had a high nitrate water supply. Following the survey of the initial site, additional sites in the same section and in adjoining sections were examined.

The survey of a given site centered about the water supplies of that site. In addition to farm wells, field tile drains that were carrying water, rural school wells, springs, and streams in the vicinity were included in the survey. A qualitative test for nitrate, with diphenylamine solution, was made at the site. Information was sought concerning such features as location, depth, construction, and use of farm wells; topography and surface drainage; the location of waste organic nitrogen accumulations; and land use practices. A sample from each water supply was collected for subsequent laboratory analysis. (Laboratory analysis of water samples was done by the Minnesota Department of Health.)

Soils in the vicinity of the water supplies were observed for topography and land use. Sites for sampling were selected so as to reflect the variations in soils. The usual practice was to obtain samples within a 50-foot radius of the water supply and to supplement these with samples collected from the various soils 100 to 500 feet from the water supply. Composite samples of surface soil, made up of from 4 to 6 subsamples, were taken from the 0- to 6-inch soil layer, and corresponding subsoil samples were taken at a depth of 30 to 36 inches with a soil auger.

The nitrate content of the soil and water samples returned to the laboratory was determined quantitatively by standard methods using phenoldisulfonic acid (6, 7). (Nitrate is

measured and reported as parts per million nitrate nitrogen, or  $\text{NO}_3\text{-N}$ , which denotes the amount of nitrate in terms of its nitrogen.) The nitrifying capacity of each surface soil sample was determined by conventional methods of soil microbiology (8). Each soil was rated low, medium, high, or very high in nitrifying capacity on the basis of the quantity of nitrate produced by 100 gm. of soil incubated in the presence and in the absence of added ammonium nitrogen during a 6-week period. Solution culture studies using each surface soil as an inoculum provided additional data in rating the nitrifying capacity of each soil. Soils rated low produced less than 3 p.p.m. nitrate nitrogen during incubation for 6 weeks in the absence of added ammonium nitrogen and less than 35 p.p.m. nitrate nitrogen when 30 mg. ammonium nitrogen had been added. Soils rated very high produced more than 100 p.p.m. nitrate nitrogen without added nitrogen and more than 700 p.p.m. nitrate nitrogen in the presence of added nitrogen.

## Results and Discussion

Almost all of the wells examined were of dug or bored construction and were relatively shallow, generally 15 to 50 feet deep. Exceptions to these characteristics are noted in the tables.

The concentrations of nitrate found in the waters sampled and in soils in the vicinity of the water supply are listed in tables 1, 2, and 3. (Data for soil samples taken beyond 50 feet from the water supply are not given, since these samples numbered only 7 for surface soil and 6 for subsoil.) The nitrate content of the soils varied greatly within a short distance, and the same soil varied considerably with the time of sampling. Nitrates in the surface soil maintained no constant relation to the nitrates in the parent material (subsoil samples) of that soil. There was no relation between the nitrate content of the water and that of the soils at the time of sampling. The variations in soil nitrate content are to be expected, since the nitrates that are produced in the surface soil are subject to leaching by rainfall and to utilization by microorganisms and higher plants.

The data on nitrate concentrations must be

Table 4. Nitrate content of water supplies in relation to their location and to the land use and nitrifying capacity of nearby soils

Site	Water supply	NO <sub>3</sub> N in water (p.p.m.)		Location with respect to possible pollution <sup>1</sup>	Soils of vicinity	
		First sam- pling	Second sam- pling		Land use	Nitrifying capacity
Water supplies of high NO <sub>3</sub> N						
1	Farm well A	120	92	Poor	{ Barnyard Sod Cultivated	Very high. Low. Low.
2	Farm well	75		Poor	Near barnyard	High.
4	Farm well	87	46	Poor	{ Barnyard Cultivated	Very high. High.
8	Farm well A	70	16	Questionable	{ Cultivated Sod	Medium. Very high.
13	Farm well	80	100	Poor	Barnyard	High to very high.
28	Farm well A		130	Poor	Barnyard	Very high.
Water supplies of moderately high NO <sub>3</sub> N						
1	{ Field farm well B Field tile	54 18	29 4	Questionable Good	{ Sod Cultivated	Low. Medium.
3	Field tile	12	6	Good	Cultivated	Medium to high.
5	Farm well	35	8	Good	Cultivated	High.
12	{ Farm well A Farm well D	13 15	22 23	Poor Good	{ Barnyard Sod	High. Medium to high.
19	Farm well	40		Questionable	Cultivated	Low.
21	Farm well	18		Poor	{ Barnyard Cultivated	Very high. Medium.
Water supplies of low NO <sub>3</sub> N						
3	Farm well	10		Questionable	Sod	High.
6	Farm well	9		Poor	Near barnyard	Very high.
10	Spring	6.4	8.5	Good	Cultivated	Low.
11	School well	1.7		Good	{ Sod Cultivated	High. Low.
12	Field tile		6.2	Good	Cultivated	Medium.
14	Farm well <sup>2</sup>	2.3		Poor	Barnyard	Medium.
15	Farm well	6.3		Good	Cultivated	Low.
16	Pasture well	4.4		Questionable	Sod	High.
17	{ Farm well Pasture well	4.4 4.8		Poor Questionable	{ Barnyard Sod	Very high. Low.
18	School well	1.0	1.5	Good	Sod	Low to medium.
19	{ Field tile Spring	5.2 4.1		Good Good	{ Cultivated Cultivated	Medium. Medium.
26	Farm well		8	Questionable	Sod	High.
Water supplies of very low NO <sub>3</sub> N						
5	Pasture well		1.0	Good	Sod	Medium.
7	School well	1.0	1.0	Good	Sod	Medium.
12	Farm well C <sup>3</sup>	1.0		Good	Cultivated	Low.
20	School well	1.0		Good	Sod	High.
22	School well	1.0		Good	Sod	Medium.
23	Farm well	1.0		Good	Sod	High.
25	Farm well	1.0		Good	Sod	High.
27	Farm well		1.0	Good	Sod	Medium.

<sup>1</sup> Location of the water supply was evaluated on the site. Sites classed as "poor" were located within a hundred feet of obvious concentrations of organic nitrogen. Those classed as "good" were sites well removed from any concentrations of organic nitrogen. Those sites classed as "questionable" usually were within several hundred feet of manure piles or barnyards. <sup>2</sup> Drilled well, 130 feet deep. <sup>3</sup> Drilled well, 260 feet deep.

4, water supplies with the highest concentrations of nitrate were located near soils of very high nitrifying capacity. At all but one of the sites in this group, the very high nitrifying capacity of at least one soil near each water

supply was due to a concentration of organic nitrogen. At that one, site 8, no effect of organic nitrogen contamination was readily apparent, although a hog-feeding area within 150 feet of the water supply existed a few years

**Table 2. Nitrate content of water supplies and of nearby soils in Rock County, Minn.**

Site	Water supply	Date sampled in 1951	NO <sub>3</sub> N in water (p.p.m.)	NO <sub>3</sub> N in soils within 50 feet of water supply (p.p.m.)	
				Surface	Subsoil
11	School well	July 31	1.7	19	2
	Farm well A	July 31	13	247	2
	Farm well B	Sept. 13	22	121	
12	Farm well C <sup>1</sup>	July 31	26	30	2
	Farm well D	July 31	1.0	8	2
	Field tile	Sept. 13	15	11	2
		Sept. 13	23	7	2
13	Farm well	Sept. 13	6.2	10	
		July 31	80	20	25
14	Farm well <sup>2</sup>	Sept. 13	100	15	80
15	Farm well	Aug. 1	2.3	33	32
16	Pasture well	Aug. 1	6.3	10	2
28	Farm well A	Aug. 1	4.4	14	2
	Farm well B	Sept. 13	130	138	
		Sept. 13	62	19	42

<sup>1</sup> Drilled well, 260 feet deep. <sup>2</sup> Drilled well, 130 feet deep.

**Table 3. Nitrate content of water supplies and of nearby soils in Nobles and Mower Counties, Minn.**

Site	Water supply	Date sampled in 1951	NO <sub>3</sub> N in water (p.p.m.)	NO <sub>3</sub> N in soils within 50 feet of water supply (p.p.m.)	
				Surface	Subsoil
Nobles County					
10	Spring	{ Aug. 2 Sept. 14	6.4 8.5	14 19	6
17	{ Farm well Pasture well	{ Aug. 1 Aug. 1	4.4 4.8	28 44	2 2
18	School well	{ Aug. 1 Sept. 14	1.0 1.5	6 12	2 2
19	{ Farm well Field tile Spring	{ Aug. 2 Aug. 2 Aug. 2 Sept. 14	40 5.2 4.1 4.2	20 63 20 6	2 8 3
Mower County					
20	School well	Aug. 16	1.0	7	2
21	Farm well	Aug. 16	18	38	18
22	School well	Aug. 16	1.0	11	2
23	Farm well	Aug. 16	1.0	13	3
25	Farm well	Aug. 16	1.0	8	2

cultivation near the very high nitrate waters were generally much lower in nitrifying capacity, but many of the normal field soils exhibited high nitrifying capacity despite the absence of abnormal additions of organic nitrogen. Such field soils were associated with subsoil drainage waters of up to 18 p.p.m. nitrate nitrogen and well waters of up to 35 p.p.m. nitrate nitrogen.

The rich soils of southwestern Minnesota present nearly ideal conditions for soil nitrification, limited normally by the release of ammonium nitrogen from the soil organic matter. Pollution of these soils with nitrogenous wastes will provide an excess of ammonium nitrogen and result in extremely high nitrate production. It seems possible that such soils of very high nitrifying capacity may sometimes contribute to the nitrate content of water supplies ordinarily considered to be satisfactorily located. Further study of the relation of nitrification to the accumulation of nitrate in waters will be necessary before any definite conclusions can be drawn.

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### Fluoridation of Public Water Supplies

The Supreme Court of Oregon on January 11, 1956, in the case of *Baer v. City of Bend*, confirmed the decree of the circuit court which had sustained a demurrer to the complaint brought to enjoin city officials from fluoridating the Bend water supply.

The plaintiff contended that fluoridation would deprive him of his liberty without due process of law secured by the 14th amendment and encroach on his freedom of religion secured against Federal intrusion by the first amendment and similarly secured against State intrusion by the 14th amendment. The court, noting the various cases and other authorities (and the express concession of the plaintiff that dental health is a proper field for the exercise of State authority), held that the fluoridation measure of the city of Bend was a reasonable law for the protection of the public health and did not violate any religious or other liberties guaranteed by the Constitution.

ago. Sites 6 and 17 illustrate that large concentrations of organic nitrogen in the soil adjoining a well are not necessarily reflected in a high nitrate content for that well.

Of primary interest in this study was the question of whether or not the normal field soils—the agricultural soils uncontaminated by heavy additions of organic nitrogen—might contribute to the nitrates that accumulate in the well waters of the methemoglobinemia region. The data in table 4 throw some light on this question.

The nitrifying capacity of soils other than those designated as "barnyard" ranged from low to very high. Only one of these soils, at site 8, was rated very high, and, as has already been noted, it is possible that this soil was contaminated by concentrations of organic nitrogen formerly in the vicinity. The soils of the region of Minnesota surveyed were highly productive when first placed in cultivation less than a hundred years ago. The high native fertility was due in large part to the high organic content of the soils. The effect of continued cultivation involving both good and bad land-management practices would be expected to influence the nitrifying capacities of the soils by virtue of influencing the kind and quantity of organic nitrogen present. Many of the normal soils examined demonstrated a high nitrifying capacity. The laboratory measurements of soil reaction and the field observations on the organic matter content and texture of the soils further support the conclusion that many of the soils of the region are capable of producing substantial quantities of nitrates. The addition to such soils of organic nitrogen in the form of manure fertilizers or accumulated waste from livestock will result in the very high nitrifying capacity found in the barnyard soils.

The nitrate content of certain of the waters associated with the normal field soils of medium to high nitrifying capacity is of marked interest. The data in table 4 for field tile drains reveal that drainage waters directly influenced by soil nitrification contained as much as 18 p.p.m. nitrate nitrogen. At site 5, where the direct contribution of soil nitrification was more difficult to assess, a well contained 35 p.p.m. nitrate nitrogen despite its location far from any con-

centrations of organic nitrogen. This well served only a home, and no farm buildings were within one-half mile. The cultivated field adjoining the well had a high nitrifying capacity, and it is considered likely that soil nitrification was the important factor concerned in the nitrate content of the well water at the time of the initial sampling.

None of the samples of stream or ditch water examined showed evidence of nitrate accumulation. The streams proved to be a poor index of generalized nitrate production in the areas sampled probably because the heavy algal growth in the streams kept the supply of available nitrogen low.

### Summary and Conclusions

In connection with a survey to investigate the possible relation between nitrate production in soil and nitrate concentration in waters, data on 39 water supplies from 26 sites in 4 counties of Minnesota were obtained. Samples of 59 surface soils and 50 subsurface soils associated with these waters were studied in the laboratory for nitrate content. The surface soils were also studied for capacity to produce nitrates. Laboratory data on the water and soil samples were interpreted in the light of field observations.

The 16 water supplies that were sampled a second time during the summer gave evidence that the nitrate content of the water supplies fluctuated significantly during a 5- to 6-week period. These fluctuations were considered to be due largely to soil leaching associated with the rainfall distribution. Changes in the nitrate content of the surface soils correlated well with changes in the nitrate content of the water supplies. The nitrifying capacities of the soils remained essentially constant for the two samplings.

Soils obviously contaminated with organic nitrogen by livestock had the highest nitrifying capacities. The water supplies with the highest concentrations of nitrate (75 to 130 p.p.m.) were located near such soils. However, not all water supplies near contaminated soils had unusually high nitrate content.

Normal field soils in pastures, sod, or under



ventional divisions of knowledge concerned with individual behavior and human relations. The term thus makes it possible to exclude portions of political science, for instance, which are historical or philosophical and to include work going on in biology, geography, or law. Behavioral science cuts across the present organization of academic fields, but, in spite of this, coincides to a large extent with the subject matter of the traditional social sciences. The term social science is used throughout this paper except when the term behavioral science appears in a quotation or refers to the surveys.

### The General Atmosphere

A reading of the behavioral science survey reports brings out a fundamental difference between the social sciences and the professions which can be expressed best as a difference in atmosphere or climate. There are three ways the difference in climate is expressed.

The first has to do with the premium placed on action in the professions as contrasted with development of knowledge in the social sciences.

In discussing the law school, the Harvard committee wrote, "The lawyer is attuned to the pressure for relatively immediate practical action. Many social scientists . . . resist being drawn into the vortex of action responsibility. . . . A social scientist . . . is likely to be interested primarily in the struggle for adequate noncontradictory generalizations. . . . The lawyer, on the other hand, is likely to be interested in general descriptive theory primarily insofar as it yields a clue to the solution of particular problems demanding action" (2a).

The subculture of all the professions is action oriented. The subculture of the social sciences is oriented toward analysis and explanation. This difference in climate has to be recognized in understanding the interaction processes of persons who come from the diverse backgrounds of science and practice.

Another difference in climate has to do with the deeply ingrained anti-bureaucratic, anti-hierarchical attitude of the social scientist and the ready adjustment of the professional to administrative policies and channels and to organizational requirements.

The mere conduct of the behavioral science surveys was seen as a threat by the social scientists. One social scientist at Harvard said, "The philosophy, in part, behind [these surveys] appears to be that science and scientific investigation can be channeled, organized, or even evaluated. Taking the latter, I know of no objective criteria for establishing whether a given project in basic research is 'good,' 'sensible,' 'useful,' 'worthwhile,' or even 'sane'" (2b).

Another one said, "I'm afraid you might come to some conclusions about the areas of potential growth in social science. I feel the area of potential growth lies exclusively in a genius having a new idea" (2b). This is typical of the academic individualism which prevails in the basic social sciences.

Viewed ideally, the university is a community of scholars who are roughly equal in authority and who are self-directive and self-disciplined (6). In contrast to this there is a comparative absence of the ideal of equalitarian anarchism in the professional schools. In the Harvard business school, the survey committee commented, "It is interesting to note that there have been no expressions of outright faculty opposition to central administration of the research program by the Division of Research" (2c). On the contrary, there were suggestions as to how the Division of Research, which presently "administers" the research program in the school and does not "direct" it, could be strengthened as a facilitating, coordinating, and planning unit.

In the Harvard Medical School the doctors found the anti-organizational bias of the social scientists puzzling and troubling. The physician is accustomed to being responsible to the patient and the hospital and to his colleagues and has difficulty accepting the social scientists' preference for a free scholarly approach.

The typical problem in a professional field is likely to cut across a number of scientific disciplines, and a group approach is frequently essential. Persons involved in establishing group research projects had better be sensitive, however, to the social scientist's resistances to having his work organized and made subject to an administrative hierarchy.

So much for climate. Additional differences

*A review and appraisal of behavioral science self-surveys by five universities in the light of their value for medical social workers*

# The Behavioral Sciences and the Professions

By DAVID G. FRENCH, M.Sc.

THE CONTRIBUTION of the social sciences to the practicing professions has received increasing attention since World War II. That concentrated investment in mutual destruction produced, ironically, a major impetus to the science of human behavior and relationships. None of the "helping professions" today is without its contingent of members who advocate infusing professional knowledge and practice with social science theory and research.

There are, however, serious obstacles to effective collaborative work. The patterns evolved in the physical and biological sciences for relating basic and applied research do not apply directly to the field of human behavior and human relations. The social sciences are in about the 17th century in their development relative to the natural sciences. Yet the very fruitful division of labor between theory-focused and practice-focused research which has been evolved between the natural sciences and their related fields of application continues to challenge social scientists and social practitioners.

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A stimulating analysis of practice-science relationships in the social field is one of the outcomes of the surveys of the behavioral sciences conducted at Chicago, Harvard, Michigan, North Carolina, and Stanford Universities during 1953-54 under the sponsorship of the Ford Foundation. The surveys have been reported in administrative documents issued separately by the universities (1-5). Of particular interest to medical social workers and others in the health field is the survey conducted at Harvard. The Harvard Survey Committee included six professional schools in its study: medicine, public health, dentistry, business administration, education, and law. I have drawn on the Harvard survey particularly in preparing this review. The Michigan survey also included a particularly useful discussion on the utilization of the behavioral sciences in the professional fields.

One cannot read these documents without becoming aware of the striking similarity of the problems which physician and industrialist and lawyer and social worker encounter in seeking to make use of social science theory and research. This similarity stimulated the present attempt to identify common elements in the relationships of professional fields and the behavioral sciences and to suggest some of the conditions for effective collaborative work.

A parenthetical note is in order before proceeding to this review. For purposes of this paper the distinction between the behavioral sciences and social sciences is not important. Behavioral science is the term which the Ford Foundation has adopted to cut across the con-

during one of the discussions of a faculty seminar on the research basis of social welfare practice. This seminar participated in the behavioral science survey at that university. The sociologist had reviewed the findings that had been developed in social psychology about the effect of class status on the way a child responds to frustration. He then wanted to know why material of this kind could not be organized systematically and taught to social work students in place of the time-consuming and unsystematic method of case teaching. The case-work teacher finally traced her reluctance about following such a procedure to her concern lest students see class status as the only or primary factor in the child's reaction to frustration instead of as one of several forces operating in the child's experience.

The case method of teaching assures that generalizations and theories such as those about the influence of class status will always be seen in the context of the total life experience of the individual. Professionals always have to take into account the total situation which falls within the province of their particular service, not just a conveniently circumscribed aspect of it. This is probably one of the important reasons for the retention of the case method in law, in business, and in social work even as knowledge has become better organized and systematized.

The other characteristic method of the professions, as contrasted with the social sciences, in carrying on their research and educational work, is an intimate and continuing interaction with the applied field. The Harvard Law School's Committee on Legal Education said on this point, "[This professional nexus] is the only practicable insurance against getting lost in intellectual blind alleys. The scholar who isolates himself from the practice of his profession easily confuses what is intellectually challenging with what is really significant in human affairs" (2g). Now to the social scientist, exposure to and involvement in the complex and practical concerns of a profession is a hazard and may subvert his ability to make his peculiar contribution. Isolation from the concerns of a profession, on the other hand, is a hazard to the professional and may render his contribution peripheral or irrelevant.

There are many more characteristics of the social sciences and the professions which are pointed up in the behavioral science surveys. I have not attempted a systematic cataloging of them but have selected those which I think are particularly relevant to the situation of medical social work and the social sciences. The question now comes, what are the implications of this review for research and teaching in medical social work?

### Suggestions for Collaborative Work

Several general suggestions for collaborative effort can be found in the survey volumes. Before reviewing these, it is worth noting the expressions of conviction about the worthwhileness of collaborative work. A visiting committee of scholars from other universities, which was assigned the task of reviewing and commenting on the report at Harvard, wrote: "The net impression is imparted that collaboration is fraught with very great difficulties. Its advantages are so great, however, that we wish to express our belief that the gains are worth the costs" (2h).

From the University of Michigan Survey Committee comes this appraisal of the need for more active collaboration between professional schools and social science departments: "The professional school staff member is likely to be intimately acquainted with the history and the current institutional factors in the field situation. This rapport with administrators and practitioners in the field gives him valuable insights into relevant problems and variables. Those behavioral scientists whose work requires a field setting will undoubtedly find it desirable if not necessary to work in collaboration with professional school faculty who may approach the same substantive situations with somewhat different interest" (3).

A wholesome warning not to exhaust one's energies in looking for the best pattern for relating professional practitioners and social scientists is given in the Harvard report. The Harvard committee observes that the organizational formula which might insure fruitful research remains, like the philosopher's stone, undiscovered. Formulas put forward eagerly by one or another exponent of science in praec-

could be noted, but the point here is that climate does differ, and special attention to problems of acclimatization is required if the social scientist or practitioner is to survive and be useful in an alien setting.

### Differences in Goals

Now, as to differences in goals, the typical goal of the social scientist is development of adequate laws or generalizations or theories to account for the portion of the world that he studies. The typical goal of the practitioner is knowledge as a guide to actions for which he is responsible. This statement implies a black-and-white contrast between science and practice, but it should be understood that there are various shadings of gray in the actual way in which a particular social science or profession may present itself. Some of the social sciences are much "purer" than others in the sense of seeking knowledge for the sake of knowledge. There is considerable variation between campuses in this regard. The committee at Harvard concluded that, on the Harvard campus at least, "the balance seems definitely to favor the pursuit of knowledge for its own sake" (2*d*).

Just as theory rather than application takes priority in the social science disciplines, so does research methodology become a goal which is seen as worth while in itself. This acceptance of tool development as a worthwhile goal in itself is seen perhaps most clearly in the strong support expressed in several of the surveys for strengthening the field of mathematical statistics. The attitude reflects a division of labor in social science which is so taken for granted it is not always explained or justified.

However, there are some dissenting voices in the social sciences themselves with respect to methodological preoccupations. One Harvard social scientist commented that social scientists are more preoccupied with ways of thinking about problems than in actually working on them (2*e*). And another one quoted approvingly a comment of Freud's to the effect that there comes a time when you ought to stop cleaning your spectacles and take a look through them (2*f*). All of this simply underscores the fact that between the black-and-white contrasts

being pointed up here, there are important shades of gray.

Perhaps one other difference in the goal of the social sciences and the professions is worth noting. In the professions, the object of research is not simply the condition being treated, whether it be a disease or a falling profit rate or the breakup of a family. The practitioner is interested in the facility for treating the condition. In the medical social work field, this means the physician and hospital, the medical social worker, and the various resources that can be called into play in working with the patient. Action must always be guided by understanding of both the condition and the treatment. To the scientist, however, the treatment may appear too variable to lead to knowledge of general significance, and it will not be the focus of his research as frequently as the condition being treated.

So much, then, for differences and similarities in goals. The differences appear, we must recall, at the point where two activities which are seeking to maintain their institutional identities come together. Seen from a broader view, the goals of the professions and the social sciences are unified within the broad societal goals which form the ground within which a division of labor has taken place.

### The Methods of Science and Practice

There are just two contrasts between the methods or procedures of the social sciences and professions which I want to report to you from the surveys made of the social science departments and professional schools. One is the widespread use of the case method in all the professional schools, but particularly law and business administration. The stress on the case method reflects, I think, the basic caution of the practitioner about the danger of the "trained incapacity" of the social scientist, to borrow one of Thorstein Veblen's terms. That is, the social scientist, by focusing on that portion of reality which is abstracted and brought into focus by theory, may obscure the larger context of the object of study.

An interesting instance of this came up in a discussion between a sociologist and social casework teacher at the University of Michigan

ous process of osmosis. Provision must be made for collaborative work on the part of social scientists and professionals in concept formulation and research and writing. The committee in the Harvard business school wrote on this point: "The School has recognized that research is essentially a full time activity. The School has set forth as a goal, therefore, that each member of the faculty can have the equivalent of one year in three free from instruction responsibility to engage in research" (21). This is an ambitious goal. It is based, however, on a realistic appraisal of the investment required in time and energy from the field of practice if collaborative work between practitioner and social scientist is to bear fruit.

Another way to achieve a setting for productive collaborative work between social scientists and members of professional schools is the device of dual appointments. A social scientist is given faculty status both in his own discipline, thereby protecting his own career line, and in the professional school, thereby giving him an identification with the profession and its goals. This arrangement is already in effect in several universities and no doubt has value.

If we turn to the health field, both medicine and public health, we find in the Harvard report numerous statements indicating uncertainty as to the best procedures for fostering collaborative effort. The committee states: "We are unwilling at this juncture to make specific permanent recommendations with regard to integration of behavioral scientists in the health area. There are a number of fundamental issues which involve both the behavioral sciences and the health schools on which policy decisions must be made on both sides before any sort of organizational change could be reasonably advocated" (2m).

Of the several factors one can look for in the Harvard report in explanation of this uncertainty, the underlying one seems to be the self-sufficiency of medicine and the extremely effective indoctrination which medical education is able to achieve with respect to the goals and the methods and the theory of medical care. The committee encountered extensive ignorance about the social sciences in the medical school faculty, and many doctors saw no difference be-

tween the role of social scientists and trained social workers. There were some who had strong feelings that the social scientist was not really scientific, failed to understand the problems of the physician, and did not accept the type of responsibility which seems natural to the physician.

The social scientists, on the other hand, saw the doctor committed to short-term goals which made difficult the conduct of research that did not have an immediate pay-off. Also they found that the doctors tended to insist on administrative "control" of projects, thus threatening the integrity of the research as seen by the social scientist.

Out of this analysis of the problems of research in the health setting, the Harvard committee came up with a proposal that parallels almost exactly the proposal which the Michigan faculty seminar on the research basis of social welfare practice, referred to earlier, developed with respect to the field of social work. Let me quote:

"The experience of the committee in preparing this report has made patent the need for a forum in which the study of human behavior in relation to medicine can be continued. . . . It is recommended that a standing committee drawn from the faculties of the Schools of Public Health and Medicine with appropriate representation from the Faculty of Arts and Sciences be established. The nucleus of the committee would consist of an executive secretary and sufficient clerical help to enable it to function continually. As conceived, the committee would in no sense make policy or act as an authoritarian body but would exist primarily as an interfaculty study unit and consulting service . . ." (2n).

Essentially, the approach arrived at by the Harvard committee and the Michigan faculty seminar is to avoid elaborate administrative machinery and to provide, instead, staff service and research funds to stimulate cooperative work between interested behavioral scientists and interested members of the professional school faculty. No centralized direction of research effort is contemplated, but instead a building on existing interest and strength. The approach rests on the faith that the best way

tice are suspect in any case. The fact is that collaboration remains more of an art than a science and must be played by ear if errors are to be corrected as they appear.

Nevertheless, considerable wisdom about collaboration between the sciences and fields of practice is embodied in the surveys.

The first point I wish to report is the consensus in these behavioral science surveys that the adaptations of science to the professions must take place in the professional schools. For social work, this means the application of the various behavioral sciences to social work problems will not come about if dependence is placed on departments of psychology, economics, or sociology to do this work. It must be done within and by the professional schools themselves.

The School of Education at Harvard provides an example of a bold approach to this problem. Some years ago the Harvard School of Education established the laboratory of human development and brought in a psychologist to head it. Its present head is an anthropologist. The laboratory was designed as a social science research center, not as a research service available for teachers and school administrators. The problems selected for research are those seen by the scientists as important and amenable to research with the theory and methodology available in the sciences.

Noting the heavy emphasis which has resulted on basic rather than applied problems, the Harvard committee states: "Some might feel that the School was neglecting its responsibilities to the educational profession by taking this position. It is felt, however, that more applied problems will eventually be more adequately solved if they are attacked with the methods and assumptions which have been developed by basic research, than if they are approached on an ad hoc basis. It is possible that this policy of the school will result in the neglect of more applied problems and too much emphasis on basic research, but the behavioral scientists on the staff do not think it will". (2i).

Every profession would be strengthened if a few of its professional schools set themselves the long-range task which the laboratory of

human development at Harvard has set for itself. It is worth noting that this research center is organized around one component in the educational process: the child. Other components such as the organization of the school system, the selection and training of teachers, and so forth, will need to be met with other research resources.

The surveys contain examples of other models for incorporating behavioral scientists into the professional schools. The School of Business Administration at Harvard provides us with a case in point.

A committee in the School of Business Administration expressed concern lest a scientific approach result in singling out one part of a problem, and underscored heavily the importance of seeing and weighing all the facets of a problem in the practice of business administration. The committee writes: "It is this recognition of the multidimensional character of the problems of business administration which has led to the belief at the School that the adaptation of the basic disciplines of the behavioral sciences to the problems of business administration must be made here at the School, rather than by various groups of behavioral scientists themselves. Each problem must utilize knowledge, insights, and techniques of analysis derived from more than one of the behavioral and social sciences" (2j).

How to tap the contributions of the social sciences for business administration? A number of procedures are suggested, but perhaps the crucial one is this: "There is need to add to the permanent faculty a few men thoroughly trained in the range of behavioral sciences embraced by the Social Relations Department who would serve as focal points in the faculty to assist in the adaptation of these fields to the problems of business administration" (2k). Note that it is assumed the men brought in will remain social scientists and not become experts in business administration. But their attention will be focused on the problems of business, and their research will draw heavily on the business setting for its data.

Of course, the presence of social scientists in a professional school will not affect theory and practice in the field through some mysteri-

# Trends in Brucellosis Control

By K. F. MEYER, M.D.

BRUCELLOSIS is a world health problem ranking near the top of the ever-lengthening list of infections transmitted from animals to man in its effect on human and animal health and in its economic importance (1-4). Unfortunately the extent of its prevalence in large areas of the world is virtually unknown. The number of reported cases in human beings undoubtedly does not represent the number of cases that occur. This infection directly affects large segments of the agricultural population and other exposed groups through prolonged illness and reduced capacity for work. These burdens fall particularly heavily on Latin American and Mediterranean areas where the prevalence of *Brucella melitensis* in goats is high.

## Epidemiology

Most of the infections result from direct contact with post birth discharges, fetal membranes, and fetuses from infected animals when they give birth or abort, or from contact during slaughter. A significant number of patients

also acquire it through ingestion of dairy products from infected cattle and goats.

The three species of *Brucella* known to infect man—*abortus*, *melitensis* and *suis*—resemble each other so closely that they can be distinguished only by special tests. Probably these three species descended from a common bacterial ancestor and acquired special characteristics on adaptation to a new host. The fairly balanced relationship between *B. abortus* and cattle suggests that this species may have been the first. In general, swine and goats react more strongly to infection by *B. suis* and *B. melitensis*, respectively, than cattle do to *B. abortus*. There may be further support for the idea that *B. abortus* is the oldest species in the conjectured absence, or at least infrequency, of natural *Brucella* infection among wild animals. It does, however, occur in the American bison, the water buffalo, and the European hare. The docile ox was among the first animals to be domesticated by man; swine, sheep, and goats entered his environment later. The reactions of all animals, including man, that acquire *B. melitensis* or *B. suis* infections speak of the more recent appearance of these two species.

In areas where numerous herds of cattle are infected by *B. abortus*, persons who drink unpasteurized milk are exposed to it. Although the tissues of these persons are invaded, clinical signs and symptoms arise in remarkably fewer persons than the number actually infected. In a rural population exposed to bovine brucellosis through consumption of raw milk, the intradermal skin test using brucellergen may yield a high percentage of positive results but very few clinical cases of brucellosis.

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Dr. Meyer is director emeritus, George Williams Hooper Foundation for Medical Research, and professor emeritus of experimental pathology at the University of California. This paper is based on an address given at the United States-Mexico Border Public Health Association meeting in May 1955. The original paper appeared in the April 1956 issue of the *Boletín de la Oficina Sanitaria Panamericana* in the Spanish language. Briefs of six other papers given at the meeting appeared in *Public Health Reports*, December 1955, pp. 1213-1221.

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to define problems and plan research is to do research. Regardless at what point one starts, an encounter with the data brings to the fore the salient problems and directs research effort along these lines.

## Conclusion

The kind of surveys sponsored by the Ford Foundation and carried out by the five universities are valuable and have their place. They are an excellent first step in establishing communication and in identifying common interests and goals. Not until research is under way, however, not until particular social scientists and particular members of practicing professions sit down together to design research and collect and analyze data, will we be able to answer the kinds of questions which caused the Harvard committee to refuse to make specific recommendations as to how to integrate the social sciences and the health professions.

Medical social work is in a strategic position in many respects to work out and demonstrate effective ways of bringing the specialized approaches of the behavioral sciences to the problems of practice in both the health and welfare fields. Medical social workers know their way around the health field; they are aware of the subculture of the hospital and clinic;

and they share the same sense of responsibility as does the medical doctor with respect to the patient. At the same time, the primary focus of the medical social worker is the same as that of the social scientist: individuals and institutions and their interaction.

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## Application Deadlines Waived

Deadlines for filing applications for research grants for studies of limited scope and size have been waived by the National Institutes of Health of the Public Health Service in order to provide rapid and flexible support for meritorious, limited studies. As of March 21, 1956, the usual deadlines of March 1, July 1, and November 1 have been waived, on an experimental basis, for about one year.

Types of applications still subject to "regular deadlines" are those that request more than \$2,000 plus indirect costs or request more than

one year of support or supplements to existing grants or applications.

Other policies and rules governing applications remain in force. If more extensive support should be required to continue the studies initiated, the investigator should apply for a grant according to the usual deadlines. Grants are not intended to support research typically designed for writing a thesis.

All applications as well as requests for forms or information should be addressed to the Division of Research Grants, National Institutes of Health, Bethesda 14, Md.



been estimated at between \$3 million and \$25 million. Unfortunately, similar estimates are not available for other countries.

Bovine brucellosis, wherever it occurs, is the cause of very considerable economic loss to the dairyman, with effects probably greater than he generally has realized. Norway has estimated the cost of eradication at less than one year's economic loss due to the disease.

Equally incomplete are the estimates on the losses sustained as the result of brucellosis in goat and sheep raising areas. In southern France, 15 to 40 percent of the flocks or herds are infected; 10 to 40 percent of the infected goats or sheep abort; and thus, annually 100,000 ewes and 50,000 goat kids are lost (?). No one has yet appraised the impact of these losses, in combination with the ravages of disease, on health and well-being in many countries. This negligence is in great part attributable to the lack of recognition by many that this disease is a specific entity because it is so insidious and difficult to diagnose.

### Control

In improving the welfare of countries throughout the world, brucellosis must obviously be considered. The World Health Organization and the Food and Agricultural Organization, advised by an expert panel comprised of medical and veterinary experts from all parts of the world, closely collaborating with the International Office of Epizootics and several inter-American congresses, are attacking the problems on a worldwide basis. Human brucellosis can be prevented only if the disease is eliminated from animals. The present goal—complete eradication of bovine brucellosis, rather than adaptation to it—guides the measures taken by these groups.

This is a difficult task, but progress made in the United States, Puerto Rico, and Scandinavian countries (8) gives cause for hope. That infection in cows can be recognized with considerable accuracy by a simple test for agglutinins in their serum was proved nearly 50 years ago. To eradicate bovine brucellosis, early efforts were directed toward destruction of reactors in this test, just as they were in the

campaign against tuberculosis. Regrettably, the test-and-slaughter type of control, when conscientiously followed, is so costly in some parts of the world that it has not been practical to adopt it on a worldwide basis.

Cooperation of the livestock owner cannot depend on legislation alone. An effective educational program, fortified with accurate information, must leave no doubt in the minds of all concerned that living without brucellosis is a desirable necessity.

Efforts to devise an effective, workable, and acceptable control program brought to light several shortcomings in the original planning. Possibly one of the most troublesome is the nature of the agglutination test itself. It has the advantage of being comparatively inexpensive and may be repeated as often as necessary, but it has some disadvantages. For one, the results may be misleading. The serum from some uninfected cows may cause nonspecific agglutination, or early in the infection agglutinins may not be detectable. It has happened that herds considered to be free from the infection on the basis of the test and subsequent slaughter of the reactors later became infected. This disappointing and sometimes disastrous failure occurred usually when the slaughtered animals had been replaced with stock from herds not included in the testing program. Another shortcoming was lack of proper and comprehensive education of all groups concerned and consequently difficulties in the organization of cooperative efforts between livestock owners and livestock sanitary officials.

At a disappointing stage of the control program, progress took a significant and encouraging turn. Through research by Buck (9), Buck and Cotton (10), and Traum (11), a *B. abortus* strain, strain 19, proved effective in preventing abortion in heifers vaccinated when they were 4 to 8 months old. In experimental studies, heifers vaccinated as calves have maintained, during their first gestation, a serviceable protection against brucellosis when exposed by contact with infected cattle. Strain 19, living but attenuated, provides protection, usually without causing disease, because it is of stabilized virulence and produces a low-grade, temporary infection from which the vaccinated ani-

In addition to the relatively low virulence of *B. abortus*, other factors tend to lessen the danger of drinking milk contaminated with that organism. Infected milk may be diluted with large amounts of uninfected milk at the dairy; but more important, children, the consumers of the largest quantities of milk, are naturally resistant to clinical illness after exposure to *Brucella*. These conditions account for the fact that most human brucellosis due to *B. abortus* results from direct contact with farm animals or their carcasses, but they do not minimize the necessity for pasteurization.

The organisms usually enter through intact skin or mucous membrane. Most of the people who contract clinical cases of brucellosis due to *B. abortus* have handled infected cattle, occasionally infected hogs. Hogs in close association with infected cattle in feed lots may acquire *B. abortus*. Recently sheep in California have also been found to be infected with *B. abortus*.

In some States, such as Iowa, where swine breeding is carried on extensively, swine brucellosis constitutes a threat to human welfare. It may be transmitted to man in two ways: by direct contact with infected hogs or by indirect spread to dairy cattle sharing premises with infected hogs. Under the latter circumstance, the potentialities are worth considering because *B. suis*, in general more pathogenic for man than *B. abortus*, may, in rare instances, reach consumers of raw milk. Usually, however, it is sporadic, appearing in persons who suffer individual exposure by direct contact with single infected animals on the farm or in the slaughterhouse.

Brucellosis in goats is widespread and is the chief source of human brucellosis in Mexico, France, Italy, Spain, Yugoslavia, Turkey, Israel, and Egypt. About 30 years ago the goat was the source of a limited number of cases in southwestern United States. The mortality rate ranges from 4 to 11 percent. *B. melitensis* may infect cattle too, and the situation mentioned with regard to *B. suis* may arise—consumers of raw milk may become infected. In the United States, human infection with *B. melitensis* has recently been traced to hogs. In other countries, for example, in France and recently Germany (5), sheep have

been proved important sources of severe, even fatal, human infections.

The portal of entry of *B. melitensis* is by ingestion, contact, or inhalation of infected dust in the environment of the livestock. Both goats and sheep are the source of dairy products, particularly fresh cheese, and these may be teeming with *Brucella*. If the cheese is sticky, it is likely to remain in the mouth for an appreciable time, thus giving opportunity for the organisms to enter by way of the mucous membrane of the mouth and to bypass the potentially destructive gastric juices. Usually, in human brucellosis of caprine origin, several members of a family are infected simultaneously; in brucellosis of bovine origin, only single cases occur in households.

The soil in goat corrals and stables may be heavily contaminated with *Brucella* that continuously pass in the feces. Being resistant to desiccation, the viable organisms are readily disbursed in the dust stirred up by moving animals. Ingestion of stagnant water from watering places in goat corrals is also a potential source of infection for the goats.

### Economic Aspects

Brucellosis, in contrast to many other zoonoses, is responsible not only for widespread illness and misery among human beings, but also for serious economic losses to those who deal in livestock. These losses are of such appalling size in some areas that they are the subject of more concern to many groups than the burdens of disease carried by the people who contract it. In general, the losses consist of (a) decrease in milk supply—an average of 22 percent; (b) loss in offspring because of destruction of fertility—an average of 40 percent—or abortion; and (c) decrease in value of infected cows, goats, sheep, swine, and horses.

According to figures of the National Research Council (6), at least 1,300,000 dairy cows and 800,000 beef cattle in the United States had brucellosis, and the resultant financial loss was estimated at \$100 million. According to a more recent estimate by the Agriculture Research Service, the annual loss has been reduced to \$45 million. The damage caused by *B. abortus* to agriculture in Switzerland during 1 year has

Manthei (14) used culture of milk to determine the infection status of vaccinated and unvaccinated herds, and by this means were able to evaluate the shedder status, seroagglutination test, and the relationship of these to vaccination with strain 19.

There is no need to emphasize again that the final determination of the infection status, of either an individual or herd, cannot be made safely on the basis of the ring test or culture of milk alone. These procedures have certain inherent limitations, especially when applied to vaccinated herds, but they are exceedingly valuable when used as supplements to the blood test. When proper use is made of all these procedures, each in its proper place, together with prompt identification and removal or segregation of diseased animals and with application of sound sanitary practice, satisfactory progress towards eradication can be expected to continue.

When undue weight is given to a negative ring test, when blood test reactions shown by vaccinated animals are ignored or unduly discounted, or when seroreactors, untested animals, or seronegative animals from herds of unknown origin are permitted to move in the channel of trade other than to immediate slaughter, progress towards eradication is impeded. It is, of course, wasteful to introduce infection-free animals into infected herds, as experience in Latin America has regrettably shown.

Certainly the interstate regulations pertaining to brucellosis within the United States, as recommended in 1953 (16), might very well be applied to the regulation of importation of cattle into the Latin American countries.

#### *Caprine Brucellosis*

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Until the tests in Tunis are more complete, recommendations for control rest on former experiences.

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To insure proper supervision of production of the standard vaccine, the California Legislature has empowered the State health department to test biological products and enforce proper transport and storage methods. In California, which has adopted a compulsory vaccination program, and in other States with semicompulsory programs, the overall protection has been remarkably good in most cases. Losses from abortion have been sharply reduced.

The degree of immunity provoked by single or multiple vaccinations has been studied, and in no instance has revaccination enhanced immunity. It is fully recognized that ultimate eradication will be achieved only by using the vaccination of calves as a supplement to blood testing and elimination of the reactors.

Until a thoroughly satisfactory practical field test is devised to distinguish between vaccinal agglutination reactions and reactions due to virulent infection, an animal whose serum reacts at certain levels in this test, whether vaccinated or not, particularly after it attains breeding age, must be considered a dangerous animal. The titer now regarded as positive is 1:200 for vaccinated animals. From the standpoint of the public's health, it is absolutely imperative that these animals, particularly if they are shedding *B. abortus* in milk, be eliminated.

Recent observations on 30 herds, consisting of 2,958 animals in which calfhood vaccination

had been practiced for 5 years, revealed 89 shedders. Only 4 herds were entirely free from infection. Since the percentage of reactors, and in particular of shedders, is low, it is reasonable to postulate that the next step is to identify the shedders by means of a simple method. From the standpoint of the beef herd, it is relevant only to remove the shedders from its midst; from the standpoint of spread of the infection, it is essential to take whatever preventive measures are possible, preferably slaughter.

The application of new methods of culturing milk and cream on special media has the advantage that it furnishes health agencies with valuable information about the progress of an eradication program in milk herds. The methods outlined by Hess and Sackmann (13) or by Goode and his associates (14) should be tried.

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This test has been used extensively in the United States and in Denmark. Three consecutive negative ring tests on a composite herd sample, 4 to 6 months apart, followed by one negative agglutination test on blood from all animals in the herd, are the criteria for freedom from infection. In Grade A herds the three negative ring tests alone are considered adequate criteria. In the United States a number of States have surveyed milk sheds in cooperation with livestock disease control agencies. This test was proved valuable as a field test, particularly in detecting *Brucella*-positive herds (14).

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fied by the normal host could be isolated, and this has been done with *B. abortus* and *B. suis* by Berman at Wisconsin University. By supplying a preformed nutritional factor to the host one could propagate the organism at will until an effective immunity is induced. At this point, withdrawal of the required growth substrate would stop growth of the organism, and the host's normal and actively acquired immunity would clear the host's tissue of the organism.

To this end, Elberg and his associates developed a largely streptomycin-dependent mutant of *B. melitensis*. This mutant protected 50 percent of animals vaccinated with it against fairly heavy challenge—the  $ID_{50}$  (infectious dose) for mice, 10 to 20 percent; for guinea pigs, 5 to 10; for goats, 1; and for monkeys, 5. Challenge consisted of two injections of  $10^{10}$  cells administered subcutaneously.

Unfortunately, streptomycin could not reach the intracellularly located organisms and therefore could not stimulate their growth. They were able to multiply threefold to fourfold, using the streptomycin they had accumulated in their cytoplasm during growth on the agar containing streptomycin. The strain was not pathogenic according to gross and microscopic histopathologic criteria.

A more proliferative immunizing agent was then isolated from the drug-dependent population on drug-free medium. This mutant was studied carefully and found not to be drug dependent. It was not pathogenic for goats nor for some other animals, but it was less attenuated than the streptomycin-dependent strains in that it multiplied more profusely in mice and guinea pigs. As a result of this ability to multiply, revertant strain 1, among others, was able, in a dose of  $10^3$  cells, to immunize 70 percent of mice against 220  $ID_{50}$  and 60 percent of guinea pigs against 35 to 50  $ID_{50}$ . Goats and monkeys have not yet been tested.

The in vivo proliferation of revertant strain 1 is such that it multiplies and persists in the spleen of the vaccinated for 11 weeks before it is cleared from the organs. Challenge is conducted at least 6 weeks after the strain is cleared. It is believed that the actual imprint of the immunity depots is more intense quantitatively, and hypothetically it may be taking place with

antigens only slightly, if at all, produced in vitro.

These observations can be interpreted as follows: A living attenuated *B. melitensis* that persists in the tissues after inoculation for only a limited time and produces a "native" *Brucella* antigen does protect highly susceptible small laboratory animals against a moderately severe infection. Apparently a *B. melitensis* variant may be obtained through adaptation of the organisms in vitro. The protective value of such a variant in active immunization of goats has yet to be determined.

Why has this apparently complicated road of experimentation been chosen? The chance of selecting from a *B. melitensis* population growing on a culture plate, a variant of low pathogenicity and high immunogenicity, is so low and the work entailed so time consuming that forcing the development of an immunogenic strain by gradual adaptation to streptomycin seems more promising. Actual experimentation justified the taking of this road, and the progress being made brings the development of an effective method of immunization against caprine brucellosis much nearer.

Rather unfortunately, only two laboratories—the Brucellosis Center at the Pasteur Institute at Tunis, supported by FAO and in cooperation with WHO, and the department of bacteriology at the University of California, assisted by a small grant from the Public Health Service National Institutes of Health—are devoting their energies to the solution of this problem of such importance to the welfare of populations who can ill afford the constant direct and indirect injuries inflicted by caprine brucellosis.

### General Recommendations

1. A control program against brucellosis should be undertaken with full, friendly cooperation of the United States Department of Agriculture, Agriculture Research Service, State and local health departments, and livestock owners.

2. A systematic survey of the extent and distribution of brucellosis in different animals where this is not known should precede formulation of a control program.

3. Well-equipped and adequately staffed central and field laboratories are essential.



and then continues to persist in the newly infected country.

In Latin America, the disease has existed for centuries and is chronic. The problems to be met are these:

1. The diagnostic tests needed to guide the recognition and elimination of infected excretors of *B. melitensis* frequently cannot be made on the scale required, and, if it can, only with great difficulties. The usual agglutination test has limitations. It must be interpreted on a herd basis, not on an individual animal basis. In a personal communication, Renoux wrote that the ring test modified for study of goat's milk appears to be highly specific if the test tubes are incubated for 12 hours at 37° C. Work on this test is also being carried out by Alivisatos and Edipides (18). The test may offer a solution to some of the present diagnostic problems. Twenty years ago, it was pointed out that the intradermal allergy test detects the infected individual goat probably more accurately than the most refined serologic tests (19). Suitable antigens are now available, but the effort required to apply the test is apparently a deterrent factor to its use.

2. Removal of goats with positive reactions to the various tests must be accompanied by strict sanitary herd management, particularly in areas where goats and man live in close association. Those familiar with goat-breeding practices carried out by poor settlers and farmers who own small herds that feed on natural ranges of sandy semidesert and rough and broken terrain fully appreciate the difficulties of accomplishing much in this respect. An educational program—carefully adapted to local needs and skillfully executed until its goals are achieved—is required to familiarize the people with the economic and social consequences of the loss of kids and lambs and the spread of the infection to man. Furthermore, it is never appreciated, and therefore rarely adequately emphasized, that the environment of human habitations where goats infected with *B. melitensis* have been housed for decades is thoroughly impregnated with the infective agent. How to remove the *Brucella* from this contaminated environment is not known, and little effort has been spent in studying the condi-

tions required to accomplish the desired results.

3. Even if all of these requirements could be met and a dependable test-and-slaughter program could be contemplated, the thoughtful health official would still need to look ahead. A primitive people dependent solely on the goat for milk and milk products must receive financial aid from their government because they can meet brucellosis only by replacing stock through importation of clean animals. This is not compatible with the economy of the countries most heavily burdened by caprine brucellosis. Temporary losses will be more than compensated for in the future. Fewer animals will be lost by abortion and productivity will be increased.

The usefulness of calfhood vaccination with strain 19 has already been touched on. This suggests the necessity of further work to find a strain of *B. melitensis* suitable for vaccination of goats and sheep. It seems apparent that no effort should be spared to discover such a vaccine. Meanwhile, one might reflect on some of the problems that lie ahead in this effort. A limited series of tests have shown that goats that have recovered from *B. melitensis* infection have an immunity that rapidly and effectively frees their tissues from the infective agent when they are given relatively large doses of virulent *B. melitensis*. They are not immune to infection with *B. abortus*. Thus, acquired immunity in goats is a proved biological state.

Little present evidence encourages the hope that a killed vaccine or strain 19 can confer an adequate immunity against the continuous chances of infection prevailing in goat-raising areas. On the other hand, an overwhelming amount of data from France, England, Australia, and the United States leave little doubt that at the moment the only effective immunity against *Brucella* abortion is induced by in vivo proliferation of the vaccinating or infecting agent. It must be concluded for the time being that the in vivo synthesis of immunizing antigens is of superior immunogenicity—either in quality or quantity—to that produced by organisms grown on artificial medium. Finding a *B. melitensis* strain with these properties is a difficult task.

Elberg, in a personal communication, offered the hypothesis that a population of *B. melitensis* which has nutritional requirements not satis-



# Service Statistics in Public Health

THE RENAISSANCE of interest among public health administrators in the planning and evaluation of public health programs highlights the importance of the work currently being done by the Public Health Conference on Records and Statistics.

Within the past three decades, a number of approaches have been made to the description of health department performance and the impact of public health programs. Outstanding results of these efforts are the several editions of appraisal forms for local health work issued by the Committee on Administrative Practice of the American Public Health Association, the tabulation of health department services prepared by the Committee on Records and Reports of the Conference of State and Territorial Health Officers, and, more recently, the Evaluation Schedule and Health Practice Indices developed by the Committee on Administrative Practice of the American Public Health Association. Successively, these several reporting instruments have been valuable tools for the use of local health departments in reviewing their operations. They have stimulated critical self-appraisal, an essential to growth and improvement of service.

As stock-taking techniques have been more widely applied, deficiencies in available operational statistics have become increasingly apparent. The volume of statistical information accumulated has steadily increased; yet much of it has been collected without specific purpose and, therefore, has been of minimum worth. Frequently, it is limited to enumeration of units of service, with no link to any sort of population base from which to measure program progress. For example, immunizations of various types, given at specified places, within designated periods of time, are customarily

counted, but they are not related to the number of children of different age groups who should be immunized. Also, it is usual to maintain figures on attendance at the several kinds of health department clinics but unusual to relate such attendance to the number of persons who needed the service provided. Statistics kept in far too many health departments are susceptible to gross tabulations only, not to the kind of analysis necessary for pinpointing problems of specific age, socioeconomic, or geographic groups, or for measuring success or failure in meeting them.

## Working Group on Service Programs

While counts of certain acts of the health department staff describe the efforts being expended for each separate program, they give no indication of what has happened as a result of the service. Although a number of health departments have recently revised their systems of compiling service statistics, no widespread agreement has been reached regarding the kind of statistical information that is most essential for the planning, operation, and evaluation of public health programs. Neither has there been any generally accepted guidance concerning the minimum amount of such information required and the kinds of breakdowns or relationships which are apt to be most generally useful.

It is to such problems that the Working Group on Service Programs—one of six working groups of the Public Health Conference on Records and Statistics—has addressed itself. The Working Group on Service Programs, until 1954 known as the Working Group on Service Statistics, is interested in data that describe and measure public health services to individuals and efforts to reduce environmental

4. Control of bovine brucellosis should be undertaken with aids recognized and available.

5. Measures should be taken to insure pasteurization of milk. The importance of pasteurization cannot be overstated; it kills *Brucella*. In areas where cow's milk is adulterated with goat's milk, this procedure must be carefully supervised.

6. Reliance on pasteurization alone, without regard for other routes of transmission, is unwise because most infections in many regions are spread by direct contact with infected animals.

7. Diagnostic reagents must be standardized and supplied by a central laboratory.

8. The manufacture and distribution of vaccine made with *B. abortus* strain 19 must be under constant control, preferably by a State or national health or agricultural agency.

9. The official brucellosis eradication program should, whenever and wherever practical, be supervised by full-time State, preferably public health, veterinarians, cooperating with livestock sanitary officials.

10. Serious consideration should be given to adoption of regulations that permit importation only of official calfhood-vaccinated animals over 30 months of age and under 36 months of age, provided the blood test within 30 days of shipment does not disclose a reaction exceeding incomplete in a dilution of 1:200.

11. A brucellosis center, devoting all its efforts to the development of an effective vaccine against caprine brucellosis, should be established in one of the Latin American countries. A committee of experts studying the immunology of this infection should be invited to serve as advisers.

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# Basic Principles Governing Service Statistics in Public Health

The following principles should govern the collection, tabulation, analysis, and interpretation of service statistics:

## Principle 1

Service statistics should serve one or more of these purposes:

Help define the health problems of the community.

Help measure extent of the program.

Help measure progress in relation to problems.

Help furnish a basis for future program planning.

Help provide data required periodically by the general public, local appropriating bodies, and State and Federal health agencies contributing financial aid.

## Principle 2

Information accumulated for service statistics should meet the following tests:

Should be not only useful but actually used.

Should be valid.

Should be significant for the purpose it is supposed to serve.

Should be readily available.

Should justify the time and expense involved in its collection.

It is recognized that accepted criteria for tests of validity and significance of certain types of information are not available at present. Establishment of such criteria is a project in itself and one which should be undertaken as early as possible in order that the importance of the utility factor could be judged against the importance of the availability factor.

## Principle 3

In order to be most meaningful, service statistics should be related to baseline data. Examples are:

- Demographic information, such as population by age groups, natality, morbidity, and mortality information.

- Information regarding the housing, sanitation, nutritional, and general economic status of the community.

- Health needs of special groups.

- Information describing health facilities, services, and personnel available, under public, voluntary, and private auspices.

- Information reflecting expenditures.

Definite provision should be made for correlating baseline data with the service statistics accumulated. Too frequently, while the several bodies of information are available, there is no organized method by which they are brought together.

## Principle 4

The most important concept concerning service statistics is that such statistics should, generally speaking, measure services directed to individuals and their environmental hazards, including results attained, and not attempt to measure staff activities.

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*Report of the Working Group on Service Programs, essentially as approved April 27-29, 1955, by the Public Health Conference on Records and Statistics, Washington, D. C.*

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hazards. Problems of registration and legislation pertaining to vital events are being considered by the other working groups of the conference—the working groups on (a) marriage and divorce, (b) methodology, (c) model legislation, (d) mortality, and (e) natality and fetal death.

The Public Health Conference on Records and Statistics was established in 1949 for the development and improvement of public health records and statistics. Membership of the conference is made up of representatives of vital and public health statistics programs of each State and Territory. The National Office of Vital Statistics serves as secretariat to the conference, and representatives of Federal and voluntary health agencies and of schools of public health participate in working group activities.

The several working groups engage in a year-round work program, which includes performance of basic studies, preparation of technical reports, and formulation of recommendations for consideration and action of the conference. Particularly significant to the guidance of effective public health action and measurement of progress are several documents which have been developed by the Working Group on Service Programs. These statements or guides have evolved from the experience and needs of the working group members and their colleagues from program divisions in the several health departments represented. In reaching its conclusions, the group has had continuous consultative service from professional leaders in the respective subject matter areas to which attention has been directed.

### Meaningful Service Statistics

In order to make the conclusions of the working group widely available to public health

workers, *Public Health Reports* is publishing the series of technical reports designed to improve the quality of public health service statistics. The first report, "Basic Principles Governing Service Statistics in Public Health," follows on p. 521. This initial document proposes a number of fundamental concepts which the Working Group on Service Programs believes are essential to the development of meaningful service statistics in public health. The principles enumerated will be useful to many health departments as criteria for determining the value of program statistics being produced currently or contemplated for the future.

Guides for application of these basic principles to two specific types of health programs have also been completed. Entitled "Health Supervision of Infants and Preschool Children" and "Health Services for Children of School Age," they will be published in subsequent issues. As similar guides are developed for additional program areas and are approved by the conference for publication, they too will be released through *Public Health Reports*. A guide for home accident prevention programs is nearly completed.

These statements are in no sense an attempt to standardize either content or procedures in the development of service statistics. Prescribing specific statistical patterns which would be applicable to all health departments is neither desirable nor possible. On the other hand, a sound, widely accepted framework within which each health department may develop a program in accordance with its own particular needs and resources is badly needed for more effective program planning, operation, and evaluation. The conference believes this series of guides will contribute to that end and that each statement merits extensive study and application by public health workers.



maternity services can be obtained by relating antepartum, delivery, and postpartum services to the women who were delivered within a specified period than by getting unrelated counts of the three types of services.

Shown below is a pattern which relates service statistics for a tuberculosis screening activity to the problem, specifically, the number screened to the population concerned:

Total population screened.

Percentage of population screened.

Number of persons screened.

Number of films read.

Number of persons referred for large X-ray.

Number receiving large X-ray.

Number referred to physician.

Number of referrals completed.

Number diagnosed as active.

By such relationship of information, the number for whom rechecks were recommended, the percentage of individuals tested who had evidence of a disease, and the number confirmed by private physicians provide a guide to the validity of the test. The number for whom rechecks were recommended and completed is an indication of the adequacy of followup. Reporting on this basis makes possible good comparison of services between various areas and between selected periods of time.

#### Principle 6

Unduplicated counts of individuals receiving service is useful information to local health departments.

"Unduplicated counts of individuals" means counting only once, for a designated period of time, each separate health department client irrespective of the number and variety of health department services he receives. It is possible that a person receives more than one service from the department. In considering total volume of service given by the health agency, such a person would be counted several times. For some purposes this is desirable and important information. However, in planning, operating, and evaluating a public health program, it is also important to know the number and characteristics of each individual served by the health department. Consequently, arrangements should also be made for counting only

once each person served by the health agency. In this connection, it is also important to know where the remainder of the community received comparable services, if any. These data can then be related to the population concerned and thus assist in measuring the extent to which public health effort is reaching all the people.

#### Principle 7

Service statistics as here discussed should, for the most part, be a byproduct of administrative operation of a program.

Maintenance of records and compilation and interpretation of statistics should be an integral part of program management. Case records of individuals served by the health department constitute the best source of service data in a well-conducted department.

#### Principle 8

To promote the use of selected information from case records, the basic record system should be so designed that pertinent items can be related without the necessity of searching through scattered sources.

The record being used should permit easy recording and review of the information it contains. One possibility of achieving this end is a single case record for each client, on which is recorded all types of service rendered by the health department. The record should also be readily accessible for review after it is filed. Such a record system must be worked out within the circumstances of individual health departments.

#### Principle 9

A review of the service record for each individual under health department supervision should be made regularly, at least annually, by the supervising staff.

Case record analysis can be limited to stated times: quarterly, semiannually, or annually. Periodic review reduces handling and permits

Major emphasis should be placed on the number of persons served and types and amount of service received, and not on numbers of visits and inspections made or other such measures of volume of staff activities.

### Principle 5

In general, activity counts should not be used for service statistics.

The gravest criticism of utilizing activity counts for service statistics is the fact that a false sense of accomplishment may be engendered in health department personnel. When so many activities are recorded, there is severe temptation to think that every minute of the working time should be tabulated as evidence that full time and attention have been accorded the job. This leads to the desire to account for every letter answered, telephone call made, and even the time spent in preparing the activities report itself.

For example, items such as meetings attended as a part of duty, newspaper articles prepared, hours spent working on records, conferences with clerical personnel, attendance at professional meetings, special meetings attended, and similar activities may have administrative value to the supervisor or the program director in evaluating the distribution of staff activities, but they do not contribute directly to the measurement or evaluation of program services.

Likewise, the effectiveness of an educational program cannot be measured by number of pamphlets distributed, films shown, talks given, and so forth. Attendance at a meeting or carrying away of literature may have no relation whatsoever to what the individual learned through contact with the health information.

These questionable types of service statistics, enumerating the multitude of activities of health personnel, arise from attempts to get quantitative indexes of how much is being done in this or that program. However, mere counts of activities, without being related to the need or unmet demand for a service, add very little to knowledge of the problem or to program planning.

For example, the important thing to know in connection with immunization is the level of

immunization in the community. Counting up the number of immunizations given at specified places falls far short of giving that essential knowledge.

For measuring the amount of work done, gross counts will be meaningful only for activities expressed in standard work units, such as tuberculin tests, X-rays, clinic hours held, sputum examinations, and the like. For such activities as medical consultations, medical social work, or nursing visits, they will not be meaningful unless the content of the service is specified.

For supervision, counts of activity may be useful where work can be measured on a production basis, such as laboratory examinations made or X-ray film taken. On the other hand, when work to be evaluated is of such nature that it cannot be described in easily measurable work units, this type of information lacks validity since many factors besides numbers of activities participated in are important. A mere count of activities performed reveals neither the quality of service rendered, the time required, nor the results obtained.

For informational and budgetary purposes, such counts of activities have little meaning unless expressed in terms of progress toward a goal and of comparison with known needs and with standards for service. For determining relative emphasis placed on different segments of the program, enumeration of activities is revealing only for those parts of the program which are comparable.

As an example, a count of nursing visits or admissions for two programs cannot be considered a valid comparison of relative emphasis if one program consists of clinic and home nursing services and the other is carried out through home nursing visits alone.

The more valuable service statistics—those measuring services to individuals and the improvement of their physical environment—are based on counts of the patient load according to whatever breakdowns are significant (age, sex, race, residence, and so forth) and to the categories and amount of service received, grouped so that service is related to problem. Such data are needed for both program planning and evaluation.

For example, more useful information on

## Evaluation in Public Health

THE First National Conference on Evaluation in Public Health evolved from a need for pooling the experience of the many individuals and groups concerned with evaluation of public health activities and stimulating the development of more effective evaluative techniques. Dr. Vlado A. Getting, professor of public health practice, School of Public Health, University of Michigan, was chairman of the planning committee. He opened the conference by stating its two main objectives: to bring together the work of many in the evaluation of public health so that all may profit; and to determine which steps logically might be taken next to improve the practice of evaluation of public health activities.

### Background

Indirectly, the conference was an outgrowth of a recommendation made in 1953 by the Association of State and Territorial Health Officers:

"That a joint committee be established, representing the Public Health Service, Children's Bureau, and the Association of State and Territorial Health Officers, to develop quantitative and qualitative measurements which could be used to evaluate public health programs."

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*The First National Conference on Evaluation in Public Health was held at the School of Public Health, University of Michigan, September 12 and 13, 1955. This summary of the recommendations of the conference and some of its discussions was prepared by the Division of General Health Services, Bureau of State Services, Public Health Service, at the request of the conference's planning committee.*

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More immediately, it resulted from a meeting called in Buffalo, N. Y., on October 10, 1954, by the chairman of the association's representatives to the joint committee, Dr. J. D. Porterfield, director of the Ohio State Department of Mental Hygiene and Correction. In addition to the representatives of the Federal agencies and the State health officers, there were representatives from several organizations, which had planned or initiated studies concerned with evaluation of public health activities.

A planning committee was appointed to convene a 2-day working conference to learn more of what each group is doing and to develop a cooperative plan in which the various individual contributions could be dovetailed for the maximum contribution to the development of quantitative and qualitative measurement in public health practice.

Membership of the planning committee comprised representatives of the American Public Health Association, the Association of Business Management in Public Health, the Association of State and Territorial Health Officers, and the Children's Bureau and Public Health Service of the Department of Health, Education, and Welfare. These five agencies, in cooperation with the University of Michigan School of Public Health, sponsored the First National Conference on Evaluation in Public Health.

### Structure

The conference was designed to enable the participants to discuss methods of evaluation as they applied to one of five specific health activities. A maximum of 20 persons participated in the discussions of each section. Participants were selected on the basis of their demonstrated interest in evaluation, and they were chosen from a wide range of professional

more thorough analysis. Such a review would require for each individual service:

- A plan.
- The existence of standard criteria of service (nursing, clinic, medical, social, rehabilitation, and so forth).
- A comparison of performance as revealed in the record against the plan and the criteria of service.

Periodic review of each individual service record would provide valuable leads to evaluation of the adequacy of health department service. An accumulation of unmet needs would reveal where emphasis should be put and would indicate needs for and distribution of personnel.

For example, if an analysis is made once a year of all known tuberculosis cases to determine how many tuberculosis patients are in the hospital, how many at home, the sputum status of those at home, and the number of tuberculous individuals at home who were last examined more than a year ago, attention is focused on a specific problem and on the health department's success, or lack of it, in keeping individuals under supervision.

If, in addition, records of all new tuberculosis cases are examined to determine the stage of the disease, and the age of the patient, attention will be drawn to the success of case finding.

A summary of this type of data provides appropriating bodies with a better understanding of the health department program and its needs than does the traditional count of visits, inspections, and admissions to broad categories of service. It is recognized that information from records needs to be supplemented by personal observations and knowledge of the person doing the job.

Periodic case record analysis would be less expensive and more valuable than the accumulation of a vast quantity of uninterpreted data, which is still a wide practice among public health agencies.

While compilation of service statistics by periodic case record analysis has been initiated in several places, it has not been extensively developed. Even when such types of data are collected, the resulting tabulations are too frequently not used and are not coordinated with operation of the program.

Review procedures should provide a mechanism for closing out the records of individuals no longer needing service or for determining priority of those needing service.

### Principle 10

In order that only pertinent data be collected and that there be no duplication either of effort or data, health departments should have a committee for the development, review, and control of basic records, forms, and procedures.

In State health departments, the committee described above should include at least the director of local health services and representatives of the statistical unit, selected programs, and local health department. At either the State level or the local level, personnel who actually use records and interpret procedures should participate in their design and assist in establishing procedures for their use.

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*The basic principles have been reproduced in mimeographed form as Document 353 of the Public Health Conference on Records and Statistics by the National Office of Vital Statistics, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C. They have the endorsement of the following organizations: Association of State and Territorial Directors of Local Health Services; Council of State Directors of Public Health Nursing; Statistics Section and Committee on Administrative Practice, American Public Health Association.*





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disciplines: medicine, nursing, engineering, dentistry, sociology, administration, and psychology.

The plenary orientation session was followed by simultaneous sessions of the five sections. Section discussions were related to selected specific programs: tuberculosis control, fluoridation of water supplies, accident prevention, prematurity, and cancer control. These specific topics encouraged the consideration of concrete examples of methodology. Discussions were aimed at bringing out the component processes of evaluation which might, or might not, be common to other public health practices.

Digests of the section discussions were summarized by a resolving committee chaired by Dr. Herman E. Hilleboe, commissioner of health of New York State. The committee's summary report was presented at the final plenary session for discussion and action by the entire conference.

#### Planning—Anderson

The keynote address for the conference was delivered by Dr. Otis L. Anderson, chief of the Bureau of State Services, Public Health Service, whose formal topic was planning in relation to evaluation.

Dr. Anderson posed two basic tenets: first, that planning for the evaluation of a program should be interwoven with planning for the program itself; second, that evaluation techniques should be applied in the improvement of planning.

He enumerated the several successive phases of program planning, viewed in its broadest sense, as follows:

1. Determination of specific problems or needs.

2. Delineation of long-term and short-term goals or objectives.

3. Assessment of resources available or obtainable, including public opinion, professional attitudes, and degree of cooperation which might be expected; funds; personnel; facilities; technical knowledge, and so forth.

4. Selection of program methods or activities to be used to gain objectives.

5. Continuous or periodic evaluation of achievement or progress toward attainment of

short-term and long-term goals—both quantitative, or measurable, and qualitative, or judicious appraisals.

6. Change in goals, redirection of program, or replanning, as indicated by accomplishment, by concurrent shifts in circumstances, improvements in useful knowledge, and altered resources.

7. Evaluation of final results.

#### *Built-In Evaluation*

In this pattern of program planning, the speaker explained that evaluation is built right into the plan as an identified, integral part. Evaluation cannot be considered an adjunct to public health program development, to be pursued or omitted as convenience dictates. It must be involved as an essential ingredient of program design, serving a definite purpose. Dr. Anderson demonstrated the application of this concept to a number of specific programs.

Every phase of positive program planning contains an element of evaluation, he said. Assessment and judgment are involved, and decisions must be made whether we are determining the extent of a problem, public opinion, resources available, or completeness of technical knowledge or whether we are establishing objectives or choosing methods for action geared to achieving the objectives. Each decision depends upon considering and choosing among alternatives. This weighing of evidence throughout the planning process is an informal, almost subconscious type of evaluation—but evaluation, nonetheless. Often, by careful analysis, it is possible to identify important related facts of which we had not been aware, thus “firming up” a base for our decisions.

Only when evaluation is built in as one dimension of program planning will it assure that proper provision has been made for validly appraising the success or failure of the program and that there is guidance for reconsideration of objectives and redirection of program, as such changes are indicated. Through prompt adjustment of program, much effort and expense that otherwise might be wasted can be saved. Available resources can be rechanneled without delay into more productive and more needed activities. Unless this is done, the program plan becomes static and sterile, and

completely valueless as an administrative tool.

For any program, Dr. Anderson said, there is a better chance of achieving long-range objectives if planning provides for progress evaluation of intermediate steps and of objectives at frequent intervals. Such evaluation yields immediate results. Concurrent evaluations make it possible to identify difficulties or barriers as they occur and to apply necessary adjustments.

On the other hand, if evaluation is delayed until objectives are achieved, the program may never be evaluated. Or if the appraisal is arbitrarily timed—in connection with a reorganization or a change in administration—we may find that for a long time we have been engaging in fruitless endeavor, and that the advance in measurable program achievement, the end and aim of program planning, has not been accomplished.

#### **Need of Evaluation—Kandle**

Dr. Roscoe P. Kandle, deputy commissioner of health of New York City, talking on the need and place of evaluation in public health, urged that a fresh start be made in the evaluation of public health practices, with renewed ambition and new perspectives. The public health profession is now on "dead center" with respect to evaluation in public health, he stated.

He praised the work of past years by the Committee on Administrative Practice of the American Public Health Association, supported by the Commonwealth Fund and by other groups, in developing various methods of appraisal and evaluation of specific public health techniques. He also noted outstanding current work, such as that in evaluating several methods of tuberculosis control, in pinpointing specific causes of infant mortality and in appraising the effectiveness of efforts to reduce these problems, in carrying out precise studies of diagnostic tests and practices for control of coronary disease and hypertension, and in developing new methods and formulas for determining the number of public health nurses needed for adequate service to a community.

Nevertheless, the evaluation of widely used public health practices remains a major weakness, Dr. Kandle stated. Growth of programs has outstripped our ability and ambition for

appraisal. He directed attention to several barriers which have not been penetrated successfully:

1. There is a strong tendency to think of effort rather than of accomplishment. There are not many practical indexes of accomplishment.

2. There is a lack of true perception and precise knowledge of people's actions and beliefs about health and the changes we are trying to encourage them to make. To evaluate without taking into account the factors of the people's understandings and feelings is foolish and wasteful.

3. It is difficult to devise simple, practical evaluation procedures which can be built into everyday practice.

4. We are apt to conform too rigidly to narrow public health traditions. This produces stereotyped thinking, which limits critical, incisive analysis of our accomplishments and fresh and original approaches to our problems.

#### **Report of Resolving Committee—Hilleboe**

The extent to which the conference attained its objectives is reflected in the summary report of the Resolving Committee which was presented by Dr. Hilleboe.

Dr. Hilleboe reported that he found many similar opinions among the representatives of the five sections. He emphasized that when evaluation in public health is discussed, there must be understanding about what is to be accomplished. Accordingly, a program is needed. We also must have a plan of operation which is, of course, based on the program plan. If we evaluate what we are doing in the light of what we set out to do, then we are moving in the right direction, he said.

We can evaluate a technique, a research project, a study, an activity, an objective, a purpose, or a total program, Dr. Hilleboe continued. We need to evaluate the yardsticks, the tools of measurement, themselves. It is also true that we can do some administrative evaluation, and its importance in carrying out all of our public health programs should not be forgotten. We can evaluate both performance and measures of performance; ultimately, we must evaluate performance against our stated objectives.

This basic principle came out time and again in many of the sectional discussions, Dr. Hilleboe reported. Highlights of the rest of his report included the following:

It is possible to become so absorbed in one particular technique that an undue amount of time is spent in evaluating that single technique. Sooner or later we must determine the value of the technique to the activity in which it is used. The activity in turn must be related to objectives, and they, in turn, to the purpose of the entire program.

Evaluation in public health becomes meaningful when it originates from a critical attitude of mind and intellectual curiosity. Those are fundamental ingredients. Program evaluation requires the same meticulous skills and methodology that the epidemiologist employs in the study of an acute or chronic disease. It is not enough to make measurements; what is needed is the measurement of results. Reliable and valid techniques can produce measurable results if expertly used. Precise evaluation studies are really research projects of one kind or another, and are quite similar, in fact, to the epidemiological field studies made by health department personnel. Both use the scientific method to obtain unbiased results.

The evaluation process should employ scientific measurement and comparison in public health practice as in other fields. Certainly the public health profession should use a scientific method whether it is in administration, or the evaluation of a technique, or the activities or programs that make up the substance of public health. Evaluation studies to be sound require appropriate samples.

In evaluating techniques, reliability, validity, yield, cost, and acceptance, must be measured. But when objectives and programs are considered, the factors of adequacy and efficiency must be added to our evaluation. Cost must be taken into account because all program plans depend upon money for continued operation. It is essential to determine if the evaluation is going to be worth the time, effort, and money spent in relation to the limited resources available for all health department work.

The human factor must be recognized in the evaluation process. Suggested changes in program content and direction may threaten the

security of the individuals concerned, so evaluation must consider human relations in public health.

The several sections of the conference are in general agreement. One of the strong currents running throughout the whole discussion was the feeling that there is considerable value in exchanging ideas and experiences on evaluation, that the conference has been profitable, and that constructive, definite recommendations resulted.

It appears that the initial need is to have a small group, perhaps taken from this conference, start work on developing acceptable and unified terminology and definitions. This will enable public health people to communicate with each other more easily and precisely and to talk more profitably about evaluation.

Many of the health organizations represented here, both public and private, can look at some of their programs to see if some new evaluation projects can be set up. Within the next 12 months some evaluation projects could be started where they have not been carried on before. Every full-time health unit can begin some evaluation work even if it is only the testing of a minor technique or administrative procedure. It is up to us to find the resources within our own departments and do something in evaluation that we haven't done before. Then we can communicate with one another and exchange information of mutual benefit.

There should be another conference of this type, in about a year, to which all of us can bring the results of our new evaluation projects for open discussion. Prior to the proposed conference, copies of reports of projects can be distributed so that criticism and discussions of these evaluation projects may be more concentrated when we do convene. This would lead naturally to still further evaluation.

From our intense discussions of the past 2 days have come principles and practices in evaluation which can be useful to many health workers throughout the world. To set up a clearinghouse on evaluation in public health would be a natural followup, one which would enable all to keep abreast of present and future development in this field. It would provide for continuous exchange of experience and other information, and duplication of effort in pur-

suing the same types of evaluation might be avoided. Thus we would get the greatest benefits possible out of the human effort and the monetary expense involved.

Such a course of action may well herald a new and exciting era for public health in a changing world.

#### **Conference Action—Witmer**

Discussion of the Resolving Committee's report was opened by Dr. Helen L. Witmer, director of research, Children's Bureau, Department of Health, Education, and Welfare, who emphasized that difficulty in keeping on a straight track in planning for program evaluation arises from the fact that programs are so complex. She likened them to social institutions which, she said, can easily be divided into their component parts: purpose or objectives; personnel and clientele; rules—legal, ethical, technical (instruments, procedures, techniques); and equipment—facilities, including money activities.

One of two pertinent questions might then be asked regarding each element:

1. Is it scientifically valid? (Does the kind of staff, equipment, and procedures used lead to the desired results?) or

2. Is it good (the staff or the results) according to accepted standards?

Ideally, standards should be based on scientific validation. When this is not possible they must be based on judgment and experience. The main thing in planning and carrying out evaluation is clarity of purpose and direction.

Most of the audience discussion pertained to the recommendations proposed by the Resolving Committee. The final action of the conference was the adoption of the following recommendations:

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Copies of the full Proceedings of the First National Conference on Evaluation in Public Health may be purchased from the University Publications Distribution Service, 311 Maynard Street, Ann Arbor, Mich.

The clearinghouse function recommended by the conference has been delegated to the Subcommittee on State and Local Health Administration of the Committee on Administrative Practice of the American Public Health Association. Forms for registration of projects may be obtained from Dr. Vlado A. Getting, chairman of the subcommittee, whose address is School of Public Health, University of Michigan, Ann Arbor, Mich.

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1. That a small group be designated to develop uniform, acceptable terminology for general use in public health evaluation. (This recommendation was prompted by the fact that all groups reported that confusion concerning terminology had characterized and hindered their discussions.)

2. That each health agency represented start some evaluation project within the next 12 months and carefully document the methodology used.

3. That another conference be held within one year for the purpose of reviewing the projects and determining methods and techniques which could be used by other agencies.

4. That a clearinghouse be established for continuous exchange of experience and prevention of duplication of effort in the development of methods and criteria for evaluation.

5. That the necessary staff and financial support be obtained to set up this central agency on evaluation.



# Practical Nurse Training in the Home

By MARTIN CHERKASKY, M.D., ELIZABETH B. TORRANCE, M.A., R.N.,  
ELSIE BANDMAN, M.A., R.N., and BETTY SEIFMAN, M.A., R.N.

THE INCREASE in chronic disease has created a host of problems. These derive not only from the mounting number of chronically ill patients, but also from the long duration of chronic disease and the associated emotional, social, and economic disorders that affect both patient and family.

The changing character of illness is shown by reports from visiting nurse agencies throughout the country that their services are devoted more and more to patients with chronic disease. The Visiting Nurse Service of New York reported that in a recent 6-month period 70 percent of the visits were to patients with long-term illness.

Because chronic illness is measured in months and even years, it has become neither desirable nor possible for all the chronically ill to be cared for in hospitals, certainly not for the major period of illness. This consideration has caused many changes in the patterns of medical care (1).

Montefiore Hospital, New York City, recognizing the impossibility of providing institutional facilities for all the chronically ill and the undesirability of keeping many patients in

institutions rather than in the home with their families, embarked in 1947 upon its home care program. Techniques of providing comprehensive care to patients in the home were fully explored and have in many instances served as the pattern for home care programs throughout the country as well as abroad (2). Of particular significance throughout the United States is a growing number of organized programs of home care designed to meet the complex needs of chronically ill patients within the framework of the home (3-9).

It is fortunate that this necessity has considerable virtue. Montefiore has demonstrated that, for properly selected patients, home care is a method of choice when the basic team of the physician, nurse, and social worker is available to meet the multiple needs of the patient and his family. Of these three, none is more important in this service than the nurse.

The rise in chronic disease, which will assuredly continue, has led not only to a shortage of institutional facilities but to an even more serious shortage, that of nursing personnel. The American Nurses Association reported that there were 389,600 active professional workers at the end of 1953. Of these 231,000 were professional nurses employed in the field of hospital and institutional nursing. An additional 54,123 practical nurses were also employed in that field (10).

Although this was the largest number of professional nurses who had ever practiced in the country, the demand has kept well ahead of the supply. One of the reasons for this demand is the enormous growth of hospital facilities. In 1934 the total number of hospital beds in this

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*Dr. Cherkasky is director, and Miss Torrance is nursing executive, of Montefiore Hospital in New York City. Miss Bandman, formerly supervisor of the hospital's demonstration project for practical nurse training in the home, is now assistant nursing executive of the hospital's School of Practical Nursing. Miss Seifman succeeded Miss Bandman as supervisor of the demonstration project.*

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country, excluding those for the mentally sick and tuberculous, was 464,193, and in 1953 it was 735,215 (11).

In 1940, hospitals pressed by the growing demand of the armed forces for nursing personnel further developed a new hospital worker—the trained practical nurse. Today, patient care would be impossible in many of our hospitals were it not for the trained practical nurse, at first accepted only grudgingly by her colleagues and others in the health field. Her period of training, in contrast to the minimum 3 years for the professional registered nurse, is approximately 1 year. To qualify for practical nurse training at Montefiore Hospital, the student must have certain qualifications:

*Age:* 17-50.

*Education:* Elementary school diploma or its equivalent.

*Health:* Applicant must have good physical and mental health and moral character. Medical and dental records must be filled out by the applicant's own physician and dentist on a form provided by the school.

*Selection:* An admissions committee makes the final selection, based upon an evaluation of the applicant by personal interview, preentrance testing, and references.

Obviously the pretraining qualifications and the length and extent of training preclude the average practical nurse from assuming the same range of responsibility as the professional nurse. There is, however, no question that, with proper selection of students and a year of carefully planned and supervised training, the practical nurse is prepared for a wide range of nursing services which supplement and complement the services of the professional nurse.

In view of the great problem of chronic disease and the growth of home care programs, it is inevitable that a considerable part of the burden of nursing care in the home, as well as in the hospital, will have to be carried by the trained practical nurse.

### The Questions

In 1952, Montefiore Hospital approached the New York Foundation with a request that it support a 2-year research program designed to answer the following questions:

Without major changes in the length of the curriculum, what are the functions and services which the practical nurse is best prepared to carry out for the sick person in the home? What is the role of the practical nurse in the home on her own; as a member of an organized home care team; or as a member of a visiting nurse service? How much of the training year should be devoted to training in the home? What should be the nature of the training in the home? In addition to training in the home, what changes are desirable in the basic curriculum of practical nurse training which will enable her to do the best job in the care of the sick at home? What is the cost of such a program?

One of the conditions making our situation particularly suitable for this practical nurse demonstration was the close and vital relationship that had been built up in the preceding 5 years between the Montefiore department of home care and the Visiting Nurse Service of New York, the agency under contract for service to Montefiore home care patients (12). A VNS supervisor has also acted as nursing consultant to the program.

With an extensive experience in chronic disease, with a home care program carrying an average census of about 85 patients, with a well-established school of practical nursing, with a close tie to the Visiting Nurse Service, and, above all, with the philosophy of the team approach to the care of the chronically sick, the Montefiore Hospital division of social medicine was chosen for this project.

### Program Description

The study was scheduled for October 1, 1952, to October 1, 1954. A full-time supervisor was employed for student orientation, teaching, and general administration of the study. And a contractual agreement was drawn up to cover the care of patients under the joint service of the hospital and the Visiting Nurse Service of New York.

During the 2-year period, 159 students in the Montefiore School of Practical Nursing received a 3-week period of training in the home of patients after basic work in medical and surgical nursing. The average number of stu-

**Table 1. Average student day<sup>1</sup> in home training project**

Activity	Percent	Hours
Total-----	100	8
Time spent with patient-----	37	3
Travel-----	25	2
Clinical instruction-----	12	1
Home care conference and seminar-----	6	$\frac{1}{2}$
Formal class-----	10	$\frac{3}{4}$
Recording-----	10	$\frac{1}{4}$

<sup>1</sup> Does not include lunch.

dents in the program at any given time was six.

A typical period will be of value in presenting some of the activities in the home. During the 6 months, January 1 to June 25, 1954, there were 8 training classes consisting of a total of 35 students who each received a 3-week course in home care. Table 1 shows the average student day during home training and table 2, the activities during the period.

The transition between work in the hospital wards in which a student practical nurse was assigned to limited responsibility for a specific patient to the increased responsibility for a patient in his home presented an educational challenge.

An orientation course of several hours was given to each student on her first day and was continued for as many successive days as needed. This course included statements explaining the philosophy of the home care department, its team approach, and its many patient care func-

**Table 2. Visits to patients, nursing hours, and services of 35 students, Jan. 1 to June 25, 1954**

Item	Number
Visits to patients-----	724
Total hours-----	1,025
Services performed for patients-----	10,137
General care-----	3,767
Treatments (including physical therapy and occupational therapy)-----	1,189
Medications-----	273
Food and nutrition-----	601
Homemaking-----	359
Recording-----	1,522
Assisting doctor-----	24
Conferences-----	853
Miscellaneous (including diversion and encouragement of patient)-----	1,549

tions. The aims and services of the Visiting Nurse Service of New York, as well as the cooperative agreement between the pilot study program and the Visiting Nurse Service, were discussed. Presented in detail were the specific responsibilities of the student to the patient as well as her relationship to the supervisor and to the physician. Modified procedures, such as home methods for sterilizing instruments and thermometers, were demonstrated. Approach to the patient, entry into the home, and attitude and concern for environmental deficiencies were explained. Finally, the individual patient, his physical ailments, and his emotional and social needs were discussed preparatory to the student's initial visit.

Throughout the experience, the student participated in, and contributed to, home care team conferences. Introductory visits to the patient were made jointly by the student and the visiting nurse. At this time, the student could observe the visiting nurse's approach to the patient and her procedures. This made subsequent contacts between the student and the patient more satisfactory. Followup visits were under the guidance of the pilot study supervisor until the student exhibited mastery of a given activity. Students also visited patients with home care physicians, occupational therapists, and physiotherapists, and observed a variety of advanced procedures ranging from thoracentesis to massage and exercise. They observed the staff's interchange of information, which had as its objective improved service to the patient and the family. In the home, students performed a variety of nursing procedures as well as essential homemaking activities.

### The Answers

*What is the role of the practical nurse in the home?*

The practical nurse demonstrated during this study that she was competent and efficient in a patient's home. She was capable of performing a variety of nursing procedures ranging from a simple bath to sterile dressings, care of tracheotomy patients, administration of oxygen, and preparation of food for patients on regular and special diets. She was able to make necessary and frequently complex adjustments



of basic skills to meet individual needs in the home.

The practical nurse student, through her training in the home and family setting, developed appreciation of the patient as an individual and of the importance of family relationships in the care of the sick. Each succeeding visit increased her insight and her sensitivity to the emotional stresses and medical, nursing, and socioeconomic problems of her patient.

In a teamwork setting, the student learned the role of the physician and social worker and developed a clear understanding of her own function not only as a practical nurse, but also as a participant in the team. Personal contact between staff members and the practical nurse student fostered mutual respect and understanding. As a member of the Visiting Nurse Service team, she proved her value in effectively relieving the professional nurse of certain routine bedside nursing duties in a manner that was highly acceptable to the patient.

It is, however, important to remember that a 1-year period of training, no matter how excellent, is not designed to give the practical nurse opportunity to learn the many nursing procedures that the professional nurse studies in 3 years.

The advice of Marian G. Randall, executive director of the Visiting Nurse Service of New York, is pertinent: "Continue the excellent plan of teaching patient-centered nursing but give the student the added security of teaching her what she should not do in the home on her own, and of teaching her the signs and symptoms which indicate when she should ask for help and supervision. In the hospital there is always someone near, but in the home the nurse is without professional assistance and there is need to recognize the difference."

Preferably, the practical nurse after her year of training should work within the framework of an agency, such as a visiting nurse service, so that under supervision she may gradually assume greater responsibility in the home.

The Visiting Nurse Service of New York, for instance, employed three of the practical nurse graduates who had received home training, waiving on a trial basis the prerequisite of 1 year of graduate experience. After the VNS

supervisor became convinced of their capacity, the practical nurse graduates administered intramuscular injections to selected patients in addition to other duties.

### *How much of the training year should be devoted to training in the home?*

At the outset and on a trial basis, we allocated 3 weeks of the curriculum for the home nursing experience. The first week was devoted largely to student orientation to the program. The program as a whole was discussed, case load assigned, travel directions given, patient care given, patients' case histories studied, and diagnostic signs and symptoms discussed. It was during this first week, too, that the student made, with the visiting nurse, an introductory visit to each of her patients.

The second and third weeks were devoted to assigned case loads under fairly constant supervision of the program supervisor. During this period the various problems that arose were discussed, case studies were written, and examinations given and corrected.

As we gained experience, the faculty concluded that despite a tight curriculum a home training program extended to 4 weeks would provide a broader learning experience. The student could be given more opportunity for independent practice, with supervision as required, and a longer period in which to develop initiative, resourcefulness, and judgment. The supervisor would have more time to evaluate the student's strengths and needs.

### *What is the nature of the training in the home?*

*Observations.* The student practical nurse observed the visiting nurse giving care, which included subcutaneous injections and dressings. This was followed by the supervisor's discussion of principles involved in giving care.

*Discussion and demonstration.* The supervisor demonstrated modifications of procedures such as boiling instruments and cleaning thermometers. She then had the student demonstrate her grasp of these techniques. The visiting nurse shared with the practical nurse student some of the ingenious methods devised over the years which enabled her to work effectively in the home, such as: (a) care of equipment; (b)

improvised equipment, for example, bed rest and tray made out of cartons; slippers and wastebags made out of newspapers; paper padding in lieu of rubber sheeting.

*Formal class teaching.* Reading was assigned to students. Class discussion was held on specific illnesses and their signs, symptoms, and medication, all correlated to particular patients. Examinations were given, corrected, and reviewed with the students on an individual as well as a group basis.

Each student was assigned a particular patient for whom a written patient-care study was required. These patient-care studies were discussed and evaluated.

*Conferences and seminars.* The student attended the weekly home care conferences where patients were discussed. The students were free to ask questions. Frequently, a student's patient-care study was used as the basis for discussion at such a conference.

A 2-hour conference was held with each group of students and the occupational therapist. Here, the purpose of occupational therapy and patient suitability for occupational therapy were discussed. In turn, the students frequently called to the attention of the occupational therapist patients who seemed in need of such therapy.

At an orientation conference with the social worker, the students received further insight into understanding the patient as a person and a family member.

Scheduled informal conferences were held by the physical therapist with the students following home visits.

*Homemaking duties.* Homemaking duties, generally, were minimal. The student was primarily responsible for cleaning the bedside unit.

Since diet and preparation of food are included in the curriculum, the student was familiar with various types of diet, such as bland and salt-free. The program supervisor discussed in detail with each student the dietary requirements of her patients. She stressed the help the nurse could give the patient in understanding and continuing a diet which, while therapeutic, was sometimes quite unpleasant. Whenever necessary, the student prepared and

served a patient's food and did other minor household chores. It is interesting and significant that the practical nurse student was unenthusiastic about duties which were specifically homemaking.

*What are the necessary curriculum changes?*

The home care experience has resulted in a major reorientation of our curriculum. Not only has it improved the training of practical nurses so that they can function adequately in the home, but it also has sharpened our understanding of the kind of curriculum we require to train a practical nurse to function better in all responsibilities. Heretofore, the curriculum had been focused on mastery of subject matter and nursing procedures as isolated factual material. Even before the pilot study, the need for a patient-centered curriculum had begun to be apparent. In the pilot study, it became quite clear the student was having difficulty in integrating her learning and adapting it to each patient.

The first change was in the content and technique of presenting the more than 70 hours of "conditions of illness." Instead of teaching the major disease entities, the focus was shifted toward the patient with a disease in need of nursing care. All pertinent information relating to the disease—its etiology, symptoms, and treatment, including drugs and diet—was reviewed in the light of its contribution to effective nursing care. The patient's emotional needs and the devastating social effect of long-term illness also were integrated into the teaching program. Advanced nursing procedures, such as thoracentesis, paracentesis, and lumbar puncture, have been included in the conditions of illness course within their appropriate context, rather than presenting them as part of the nursing arts course. Ward conferences, including allied health personnel, revolving around a student's nursing plan for a specific patient have been helpful in training the patient-oriented nurse.

This orientation of the student nurse to the patient may seem so natural and right as to raise the question why it was not done before. Of course, in some measure it always has been done. The problem faced in nursing education parallels that of medical education. The focus of our teaching is so sharply directed toward

the multiplicity of facts and techniques our students must learn that we tend to forget the primary purpose of nursing education, which is care of the patient. It has been said that the technician has become both so skilled and so narrow that he knows everything about his job but its purpose. It is imperative that the attention of the student nurse be directed as positively to the entire patient as to any group of specific skills. Seeing patients as people and within a family setting is one of the best ways of accomplishing this purpose.

The second deficiency, that of lack of adequate information in the biological areas, has been remedied by another shift in the curriculum. This involved reducing the number of hours allocated to the domestic arts and the hygiene courses and increasing the allocation of hours spent on body structure and function and drugs and solutions.

Our concern with the curriculum is not ended, and it is expected that many more revisions will be made.

### Cost of Program

The cost of the 2-year demonstration of home training for student practical nurses was \$16,293. A breakdown of the expenditures follows:

<i>Personnel</i> .....	\$11,300.65
Salaries.....	10,662.98
Perquisites.....	442.92
Social Security .....	194.75
<i>Student expense</i> .....	2,411.94
Transportation.....	1,492.83
Lunches.....	887.71
Telephone .....	31.40
<i>Other expenses</i> .....	1,189.17
Travel.....	161.02
Consumable supplies.....	828.15
Statistical service.....	200.00
<i>Miscellaneous and overhead</i> .....	1,392.14
Total expenditures.....	\$16,293.90

While it cost about \$8,000 a year to conduct this project on an experimental basis, it is likely that, as a routine part of a school for practical nursing, the same program could be conducted for no more than \$7,000 a year. This is encouraging since it seems quite obvious that the additional cost of including home care in the curricu-

lum will be within the means of most schools. It must be recognized, however, that one of the reasons for the relative inexpensiveness of this additional teaching activity was the presence of a well-organized home care program and a well-organized and cooperative visiting nurse service.

### Conclusions

1. The practical nurse, with proper preparation during her training, can contribute effectively to the growing responsibility for care of patients in the home.

2. The practical nurse, with proper delineation of responsibilities, can supplement and complement the professional nurse.

3. To insure that the practical nurse is prepared for what will inevitably be her responsibility for care in the home (as well as in the hospital), the curriculum for her student training should be primarily patient-oriented. We feel this should include a 4-week period of training in the home, preferably within the framework of a well-organized home care program.

4. The sensitivity, compassion, and understanding, which are the hallmarks of the superior nurse, are not the result of training alone. In many instances, a practical nurse, properly prepared, can bring these attributes to the patient in the home or in the hospital, particularly if she is accepted as a member of the team along with the doctor, the social worker, and the professional nurse.

5. It is not difficult to insert within the curriculum the time necessary for home care, and the budgetary implications are not of such great moment as to make this financially impracticable, particularly if there is an organized program of home care and an effective and cooperating visiting nurse service. Continued experience in training practical nurses in the home and for the home should, and undoubtedly will, lead to further curriculum changes.

6. A program that brings the nursing department of a hospital and the staff of the school of practical nursing into the home has a very beneficial effect upon the attitudes and understanding of the top professional personnel. It is extremely difficult for professional workers to think about patients as whole people

in society when they are only seen in the narrow setting of an institution. Bringing the staff of the nursing school in close contact with patients, in their natural settings as members of the family in the home, cannot but favorably influence the training of the nurses in the same manner as this device is now being used to favorably influence the training of physicians (13).

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*NOTE: The Montefiore Hospital demonstration project, supported by a grant from the New York Foundation, is one of several programs sponsored by the National Association for Practical Nurse Education to determine the value of home care training in the practical nurse curriculum. A composite report including the experience of all the programs sponsored by the NAPNE will be published shortly.*

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## Joint Services Sanitary Engineer Training Courses

The first joint training courses for reserve sanitary engineer officers of the commissioned services—Army, Navy, Air Force, and Public Health Service—were held in June 1956 at the Robert A. Taft Sanitary Engineering Center of the Public Health Service in Cincinnati.

Developed jointly by the Department of Defense and Department of Health, Education, and Welfare, in collaboration with the National Research Council, these courses are especially designed for reserve engineer officers normally on inactive status. The courses will bring them up to date on professional developments in sanitary engineering and will provide information on sanitary engineering emergency operations applicable to situations in natural disasters and in military and civil defense emergencies.

*To plan an effective program for the control of gonorrhea, more understanding is needed of the clinical course of the disease, its epidemiology, and its response to treatment.*

# Unknowns and Enigmas in Gonorrhea

By IRA LEO SCHAMBERG, M.D.

THE dramatic reduction in the incidence of syphilis is one of the great achievements of the last decade. Since 1947, there has been a nationwide decrease of 93 percent in reported morbidity of primary and secondary syphilis (1). The striking reduction in the number of such patients reported from public health clinics, where morbidity reporting is most complete, as well as from private physicians, suggests that this represents a real decrease in syphilis morbidity.

Gonorrhea morbidity has not followed suit, as indicated in figures 1, 2, and 3. The purpose of this paper is to present a number of unanswered questions about this ubiquitous disease. Possibly, when some of these questions have been answered we may understand why gonorrhea is reacting so differently from syphilis to modern therapeutic and public health measures.

As Babione (2) stated in 1949, "The true in-

cidence of gonorrhea in the United States is unknown and virtually unknowable." He suggested determination of the ratio of gonorrhea to syphilis, a disease for which the incidence is known with greater accuracy, as an approach to a more valid picture of the frequency of gonorrhea. In his elaborate statistical study, he computed this ratio by age in the United States Navy for 1945 and suggested that this baseline may be used in the future in estimating changes of effectiveness of control measures applied to either gonorrhea or syphilis. The increasing difference in incidence which seems to have appeared between these two diseases in recent years would appear to make this method invalid.

Morbidity reporting of gonorrhea among civilians has always been faulty, and conclusions drawn from such data must be made extremely cautiously. Reporting by public health clinics is a great deal more accurate than reporting by private physicians. However, patients may, for a wide variety of reasons, such as employment, economic status, or convenience, transfer from clinic to private physician or vice versa. Therefore, conclusions regarding incidence based solely on morbidity reporting from public health clinics are also open to serious error (3). Reporting by the armed services is, in all likelihood, more complete than reporting by civilians, but there are, nonetheless, many deficiencies. Evidence bearing on the incidence of gonorrhea in the United States may be summarized as follows:

1. Gonorrhea trend analyses have been made

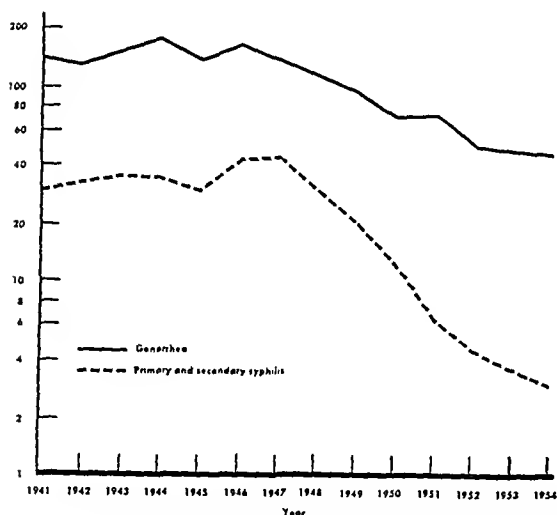
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**Figure 1. Primary and secondary syphilis and gonorrhea in the white male, 1941-54: rates per 100,000 population, continental United States.**



Source: Morbidity reports, Public Health Service.

by the Venereal Disease Program of the Public Health Service (4). In reviewing data on gonorrhea cases among nonwhite males reported by clinics in 13 of the larger cities of the country during the period 1952-54, it was observed that some of the cities showed no change in numbers of cases reported; some showed a moderate increase; and some, a moderate decrease. No uniform trend was noted.

2. Analysis of the gonorrhea case rate for the United States from 1919 through 1954 (1) shows that the case rate per 100,000 population in 1954 (152) was slightly higher than in 1919 (148). The highest incidence in 1947 (284) may have been related in part to the policy of many health departments at that time of providing the then expensive penicillin free in return for morbidity reporting of venereal disease.

3. Review of venereal disease rates in the armed services reveals a decrease in syphilis (chiefly primary and secondary stages) in the Army of 85 percent, and an increase in gonorrhea of 11 percent from 1935 through 1953. In the Navy, syphilis decreased 98 percent, gonorrhea 70 percent (personal communication from the Surgeon Generals' offices, U. S. Army and U. S. Navy). The apparent decrease in gonorrhea in the Navy may be at least partly

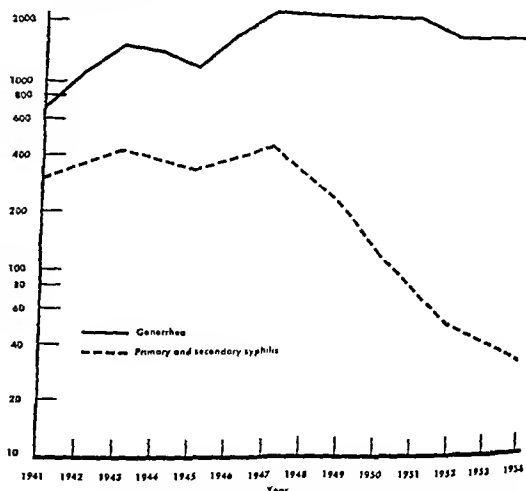
explained by the fact that the 1935 figure applied to the entire Navy, the 1953 figure only to naval personnel within the continental United States.

From these data, because of the factors mentioned above, we cannot know for certain whether gonorrhea has increased or decreased in incidence. However, it appears improbable that there has been a precipitous decline in incidence such as has occurred in early syphilis.

Many practicing physicians with whom the author has talked have expressed surprise that there is no evidence of a marked decrease in gonorrhea incidence. They state that they now see only a very few patients with gonorrhea, whereas in the past they saw many such patients. They add that complications of gonorrhea, such as arthritis and epididymitis, are now rarities. This widespread clinical impression may be at least partly explained on the following bases:

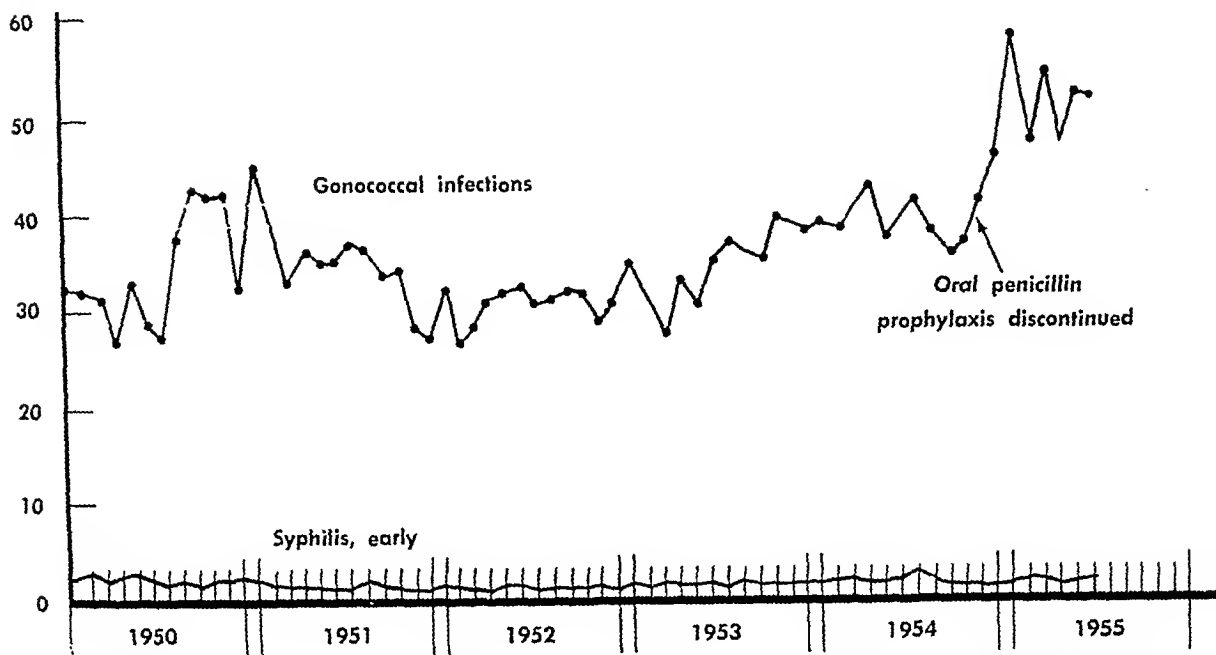
1. In the presulfonamide days (before 1937), all types of gonorrhea persisted over a period of weeks or months. If one may estimate that in those days the average male patient with gonorrhea visited a clinic or physician 3 times a week for 3 months, he would have been seen approximately 40 times. Today, the male patient with gonorrhea need be seen only once to

**Figure 2. Primary and secondary syphilis and gonorrhea in the nonwhite male, 1941-54: rates per 100,000 population, continental United States.**



Source: Morbidity reports, Public Health Service.

Figure 3. Syphilis and gonorrhea in United States Navy and Marine Corps, 1950-55: annual incidence rates per 1,000.



Source: *Stat Navy Med*, July 1953, September 1955.

receive his curative injection of penicillin. This sharp decrease in the number of times patients with gonorrhea are now seen might be interpreted by the physician as a decrease in incidence.

2. Every general practitioner today is able to cure gonorrhea promptly. Therefore, many patients who previously were referred to clinics and specialists are now being seen only by the general practitioner.

3. A change in the character of gonorrhea in the course of the past 20 years may partly explain the great decrease in complications of gonorrhea.

4. Another explanation may be that the majority of individuals infected with gonorrhea are treated relatively early with penicillin, which prevents the development of complications.

It is probable that intensive public health control measures plus widespread use of penicillin for diseases other than syphilis are the factors chiefly responsible for the dramatic decline in syphilis. One would think that gonorrhea would be more susceptible to these measures than is syphilis. In the male, the incubation period is short, permitting time for in-

fection of few sexual contacts before symptoms appear, and symptoms usually bring the patient promptly to medical care. Transmission almost solely by sexual contact limits the number of exposed individuals. Penicillin cures rapidly and makes the patient noninfectious. In addition, for the past 2 years in many areas of the country, public health measures to achieve prompt treatment of female contacts have been carried out.

On the other hand, the brief incubation period can favor the spread of gonorrhea, as has been pointed out by Magnuson in a personal communication. Penicillin given fortuitously for an unrelated condition must be given during the incubation period of gonorrhea if it is to curb infectiousness more rapidly than will penicillin given for the disease itself. It is less likely that penicillin will be received coincidentally during a brief incubation period than during a long one.

The following questions come to mind.

Q. Does penicillin cure gonorrhea?

A. Love and Finland (5) have recently shown that the gonococcus has not developed resistance to penicillin in vitro in the period 1945-54. However, there is evidence that some or-

ganisms are most sensitive to penicillin when actively metabolizing and are significantly more resistant when in a quiescent state (6). Rees (7) states, "When the gonococcus lies in a closed or intermittently draining focus, it may escape the action of penicillin, and is a potential source of reinfection if the focus is reopened." "Failure" of penicillin to cure gonorrhea has been reported by a number of authors (8-13), and may usually be explained by one of the following factors:

1. Reinfection.
2. Inadequate dosage.
3. Destruction of penicillin by penicillinase.
4. Resistance of inactive gonococci in an unfavorable environment (6).
5. Too brief blood level (aqueous penicillin, exertion, hyperemia of depot, low renal threshold, and so forth).
6. Misdiagnosis (nonspecific urethritis, and so forth).

**Q.** How long is gonorrhea infectious in the untreated female?

**A.** No evidence is available, in view of the impossibility of differentiating persistence of infection from reinfection.

**Q.** What factors cause or favor development of gonorrheal pelvic inflammatory diseases (PID)?

**A.** Some theories, no factual knowledge.

**Q.** What percentage of infected females develop PID?

**A.** Lewis (14) believes that many escape.

**Q.** What is the time interval from infection to PID?

**A.** Wertheim, as quoted by Peters (15), is said to have found gonococci in the endometrium 5 to 14 days after sex contact. There are many conjectures, but no knowledge.

**Q.** In the woman with PID does a positive cervical or urethral culture result from the original infection which caused the PID or from more recent superinfection?

**A.** No data, but in view of the lack of immunity resulting from gonorrheal infection and difficulty in culturing gonococci in women with PID of long duration, the latter appears probable.

**Q.** Is the patient with PID infectious?

**A.** In a study of sexual contacts of men with gonorrhea, Goldstein (16) found positive cervical cultures in 35 percent of the women who had PID and in only 21 percent of those found free of PID (table 1).

**Q.** Are women with repeatedly negative cultures necessarily free of infection and noninfectious?

**A.** Lewis (14) and Rees (7) believe that intermittently draining cervical glands may permit a woman to be infectious from time to time despite repeated negative cultures. The male urethra may also be a more efficient sampler and culture medium than are the physician's swab and the bacteriologist's petri dish. Koch (17) found, in women with gonorrheal cervicitis, alkaline cervical mucus and a high percentage of positive gonorrhea cultures in the first half of the menstrual cycle, acid cervical mucus and few positive cultures from the 22d to the 25th day (table 1). Therefore, negative cultures late in the menstrual cycle would appear to give no assurance of freedom from infection.

**Q.** In the female, can persistence of gonorrheal infection, relapse, reinfection, and superinfection be differentiated?

**A.** To date, no.

**Q.** Does penicillinase inactivate penicillin locally and prevent cure of gonorrheal proctitis?

**A.** Hagerman (18) found a higher relapse rate in women with proctitis and suggested that penicillinase (produced by *Bacterium coli*) inactivates penicillin in the rectum. However, Bang (19) found no evidence to support this thesis. Many bacteria produce penicillinase, an enzyme which destroys the antibacterial action of penicillin, and Tacking (20) has shown that secondary infection by one of these bacteria may inhibit the action of penicillin against pathogenic penicillin sensitive organisms in vivo.

**Q.** How can the effect of an intensive public health attack on gonorrhea be evaluated?

**A.** Greenberg and Mattison (21) have emphasized the importance of program evaluation and give examples of intermediate and ultimate objectives that may be used. The attack rates of urethritis in the male and of pelvic inflammatory disease in the female appear to be our best measuring rods.



Table 1. Gonorrhea cultures in women

Source of culture and author	Year	Type of patient	Number of women	Percent positive
<b>Cervix:</b>				
Davidson and Shepard (32)-----	1948	Named sex contacts of males with gonorrhea----	42	34
Goldstein (16)-----	1955	do-----	538	21
Somerson et al. (37)-----	1955	do-----	86	47
Cohn (28)-----	1944	"Suggestive history or suspicious symptoms of GC."	230	36
Cooke and Lankford (33)-----	1945	Obstetrics and gynecology clinic-----	2,000	23
Morton (37)-----	1945	Young women apprehended on morals charges-----	over 500	about 25
Peters (15)-----	1947	Gynecology clinic-----	2,832	14
Koch (17)-----	1947	6-16 days postmenstrual-----	14	96
		22-25 days postmenstrual-----	14	0
Goldstein (16)-----	1955	Named sex contacts with PID <sup>3</sup> -----	49	35
<b>Urethra:</b>				
Cohn (28)-----	1944	"Suggestive history or suspicious symptoms of GC."	230	18
<b>Rectum:</b>				
Bang (19)-----	1954	"Women with gonorrhea"-----	428	25
<b>Fallopian tubes:</b>				
Menge (34)-----	1897	PID-----	106	22
Hyde (34)-----		do-----	2,973	19
Andrews (34)-----		do-----	634	22
Curtis (31)-----	1921	PID with gross evidence of active inflammation-----	64	30
		PID without gross evidence of active inflammation-----	128	0
Studdiford (35)-----	1938	PID-----	24	67
Cohn (28)-----	1944	PID (7 treated with sulfa)-----	19	0
<b>Intra-abdominal fluid:</b>				
Vermeeren and TeLinde (36)---	1954	Ruptured pelvic abscesses-----	21	0

<sup>1</sup> 25 cultures. <sup>2</sup> 16 cultures. <sup>3</sup> Pelvic inflammatory disease.

**Q.** Has the attack rate of urethritis in the male and pelvic inflammatory disease in the female been reduced?

**A.** No evidence has been found for a drop in PID, but Lee (22) has shown a decrease in urethritis in the male in a rural area adjacent to a military installation during an intensive cam-

Table 2. Effect of vigorous campaign against gonorrhea in an area near a large Army camp<sup>1</sup>

Date	Morbidity (in males)	
	Civilian (number of cases)	Military (rate per 1,000)
January-June 1951 <sup>2</sup> -----	444	270
July-December 1951 <sup>3</sup> -----	398	201
January-June 1952 <sup>4</sup> -----	304	162

<sup>1</sup> Lee, S. S.: Gonorrhea control measures—A study in New Hanover County, N. C. Pub. Health Rep. 69: 998-1007, October 1954.

<sup>2</sup> 6 months prior to campaign.

<sup>3</sup> First 6 months of campaign.

<sup>4</sup> Second 6 months of campaign.

paign (table 2). Pereyra and his co-workers (3) have carried out a most interesting study in Atlanta, Ga. During an intensive 1½-year campaign, the number of nonwhite male patients applying to the health department clinic with gonorrhea has remained approximately constant. However, 15 Negro physicians practicing in the area stated on interview that they had experienced a 77-percent decrease in gonorrhea in males in their offices from 1952 through 1954. In addition, many clinic patients interviewed in 1955 stated that they had previously received treatment for gonorrhea from a private physician. The authors conclude that a shift of patients from private to clinic care conceals an actual decrease in gonorrhea incidence.

**Q.** What percentage of men sexually exposed to women with infectious gonorrhea acquire infection?

**A.** Certainly not all of them (personal communication from E. W. Thomas).

**Q.** Why do some escape?

**A.** May it be related to the length of the

urethra distal to the fossa navicularis? (Personal communication from P. Pelouze.)

**Q.** Is nongonococcal urethritis a venereal disease?

**A.** This condition is probably not a single entity, but in different patients may be due to mechanical, chemical, toxic, infectious, or psychosomatic factors, individually or in combination. Certain types may be transmitted by sexual intercourse.

**Q.** Does the gonococcus transmute into pleuropneumonia-like organisms (PPLO) under adverse conditions, and thereby become penicillin resistant?

**A.** Pleuropneumonia-like organisms cause certain animal diseases (bovine pleuropneumonia, agalactia in sheep and goats, polyarthritis in rats) and are found in normal humans in the female genital tract, throat, and saliva.

These organisms are resistant to all antibiotics except streptomycin.

They have been grown from cultures of eight different bacteria (including the gonococcus) when penicillin is added to solid culture media.

On transfer to fluid media, PPLO from *Streptobacillus moniliformis*, *Proteus*, and *Bacteroides* revert to original form; from other organisms, PPLO fails to grow. (PPLO isolated from animals and humans grow well in fluid media.)

Two theories may explain these phenomena: (a) symbiotic or accidental association of PPLO with bacteria; (b) growth phase—bacteria change to PPLO form under adverse conditions and thereby become penicillin resistant (23-27).

**Q.** Why is so little research in gonorrhea being carried out in this country? A search of the recent literature reveals significantly more investigative work on gonorrhea in the Scandinavian countries, Germany, Russia, and Great Britain than in the United States.

**A.** Reasons for this lack of research in the United States are not known.

How may we in the future learn the answers to some of these questions?

1. Better diagnostic tools might be developed, such as more sensitive cultural methods. Cohn and Grunstein (28) and Schauflier (personal communication) consider gonococcus culture an

insensitive method, in that many organisms must be inoculated in order to get growth. Another tool would be sensitive and specific serologic, skin, or other tests.

2. Repeated examination of women in a protected environment, following natural or purposeful infection, in order to observe the natural course of the disease and response to treatment. Such studies have been carried out in syphilis (29) and in gonorrhea in the male (30), and are equally permissible, feasible, and potentially valuable in gonorrhea in the female.

3. Repeated urethral and cervical cultures from women scheduled for hysterectomy. After operation, cultures from the excised cervix utilizing the following methods and materials: micropipette aspiration of cervical glands under the dissecting microscope, scraping of multiple cut surfaces, groundup pieces of tissue, and pus and exudate. Sensitivity of cultures would be greatly enhanced under these conditions.

4. After baseline studies of untreated women, similar studies on women treated with penicillin should help to answer the question whether penicillin cures gonorrhea in the female.

5. Similar studies in women with pelvic inflammatory disease scheduled for laparotomy. In the era of surgical treatment for PID, bacteriological studies at operation provided interesting data. Curtis (31) in 1921 reported on bacteriological study of fallopian tubes from 192 patients. The gonococcus was found in 30 percent of tubes showing gross evidence of active inflammation but was found in no case in which the tubes were grossly negative, even when there was histological evidence of active inflammation. Curtis stated that it is only rarely possible to obtain viable gonococci from patients who have been free from fever and leucocytosis for more than 10 days to 2 weeks. He concluded that the gonococcus lives only a short time in the tube, and that persistently or recurrently active gonorrheal salpingitis is due either to recurrence of infection from without (reinfection) or to repeated invasion of bacteria from the chronically infected lower genital tract. Such studies should be repeated using the most sensitive present-day cultural methods.

## Conclusions

1. The true incidence of gonorrhea in the United States is unknown.
2. Widespread use of antibiotics and intensive control measures have reduced the attack rate of syphilis 93 percent in the past 8 years. It is unlikely that gonorrhea has declined to a similar extent.
3. The reasons for this difference in response to treatment are not known.
4. Interest in research in gonorrhea is at an all time low in this country.
5. To gain the knowledge needed to press the battle against the gonococcus, there must be a reawakening of interest in gonorrhea among research workers, as well as among those who provide the funds.

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## CDC Laboratory Refresher Training Courses

The Communicable Disease Center of the Public Health Service will give its annual laboratory refresher training courses in Chamblee, Ga., July 1956 through June 1957, according to the following schedule:

Laboratory methods in the diagnosis of bacterial diseases:

Part 1. General bacteriology. September 10-21.

Part 2. General bacteriology. September 24-October 5.

Enteric bacteriology. October 8-19.

Laboratory methods in the diagnosis of parasitic diseases:

Part 1. Intestinal parasites. September 10-October 5.

Part 2. Blood parasites. October 8-26.

Laboratory methods in the diagnosis of viral and rickettsial diseases. October 15-26.

Laboratory methods in the diagnosis of rabies. October 29-November 2.

Laboratory methods in medical mycology:

Part 1. Cutaneous pathogenic fungi. January 7-18.

Part 2. Subcutaneous and systemic fungi. (Completion of part 1 or the equivalent education or experience is a prerequisite.) January 21-February 1.

Laboratory methods in the diagnosis of tuberculosis. January 21-February 1.

Laboratory methods in the study of pulmonary mycoses. February 4-15.

Laboratory diagnostic methods in veterinary mycology. February 25-March 1.

Laboratory methods in the diagnosis of viral and rickettsial diseases. March 11-22.

Serologic methods in the diagnosis of parasitic and mycotic infections. March 11-22.

Laboratory methods in the diagnosis of rabies. March 25-29.

By special arrangement the following courses will be offered:

Laboratory methods in the diagnosis of malaria.

Virus isolation and identification techniques.

Typing of *Corynebacterium diphtheriae*.

Special problems in enteric bacteriology.

Phage typing of *Salmonella typhosa*.

Laboratory methods in diagnosis of leptospirosis.

Serologic differentiation of streptococci.

Information and application forms should be requested from Laboratory Training Services, Communicable Disease Center, Public Health Service, P. O. Box 185, Chamblee, Ga.

# Variation in Mortality From Heart Disease

—Race, Sex, and Socioeconomic Status—

By ABRAHAM M. LILIENTFELD, M.D., M.P.H.

ONE of the more important reasons for obtaining knowledge of the distribution of a disease in a population is that such knowledge provides a means by which hypotheses concerning pathogenesis can be evaluated. If a hypothesis does not adequately account for at least a majority of the epidemiological features of a disease, it will have to be modified in whole or in part.

The distribution of coronary disease in various socioeconomic groups of the population is particularly pertinent to several etiological hypotheses that have been advanced. From official studies of occupational mortality, Logan has reported the relative mortality risks from coronary disease in England and Wales for five social classes (1-3). He has observed that among men the highest social class has consistently had (both in 1930-32 and 1950) the highest mortality from coronary disease and that the mortality risk decreases with a decrease

in social status. For married women the social class variation has not been as large nor as consistent. In 1930-32 the pattern for married women was similar to that observed among men, but in 1950 little variation by social class was noted in those aged 20-64. For married women 65 years of age and over the social class pattern of proportionate mortality ratios was similar to that observed among men, although it must be realized that proportionate mortality ratios are difficult to interpret. These distributions may be considered as being consistent with the hypothesis proposed by Keys that excessive fat consumption is an important etiological factor in coronary disease (4). It is also consistent with the observation made by Morris and his associates that physical inactivity increases the risk of coronary disease (5).

Logan has also reported the results of an analysis of mortality from other forms of myocardial degeneration in England and Wales (1-3). The social class distribution for this category is exactly opposite to that observed for mortality from coronary disease; that is, the mortality risk is highest in the lowest social class and it decreases with an increase in social status. This observation suggests that the social class differences with regard to coronary disease mortality might be the result of variation in diagnostic practices in the various social classes. It is conceivable that the greater availability of medical care may have increased the number of diagnoses of coronary disease in the upper income groups.

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In view of the difficulties of diagnosis for the various forms of heart disease, it occurred to me that a combination of the deaths from coronary disease and other myocardial degeneration might be about the same for all social groups. In an attempt to study this particular question, I have made an analysis of the mortality from heart disease in Baltimore, Md., for the 3-year period 1949 through 1951. This report presents the results of that analysis. In addition to data on coronary disease and myocardial degeneration, data on hypertension and other forms of heart disease are included.

### Method of Study

During the period 1949 through 1951, 14,504 deaths certified as due to heart disease were recorded in Baltimore. Of these, 3,016, or about 21 percent, occurred in the nonwhite population. The distribution of deaths for five categories of heart disease by race and sex are presented in table 1.

To estimate the socioeconomic status for each heart disease death, information concerning characteristics of census tracts in Baltimore published by the United States Bureau of the Census was used. The census tract comprises a neighborhood of between 3,000 and 6,000 persons who are relatively homogenous with regard to such characteristics as median monthly rental, occupational status, and extent of home ownership.

The census tracts in Baltimore were ranked according to the median monthly rental as determined in the 1950 census and then assembled into fifths so that about 20 percent of the city's

population of about 950,000 fell into each fifth. The median monthly rental was considered a valid index of relative socioeconomic status because of its high correlation with the other indexes, such as family income, years of school completed, and occupation. The lowest socioeconomic fifth was designated 1; the next fifth, 2; and so on. Each heart disease death was assigned to a socioeconomic fifth on the basis of its allocation to a given census tract from the street address on the death certificate.

One possible limitation to this method of socioeconomic classification, particularly with regard to nonwhite persons, should be noted. Because the method is based on average characteristics of an area rather than actual characteristics of an individual, nonwhites, for example, may be classified in a socioeconomic group higher than their socioeconomic circumstances warrant when they are located in a census tract that is predominantly white. The same difficulty is present with regard to the white population but probably to a lesser extent. However, census-tract classification provides an inexpensive and readily available method for studying the socioeconomic distribution of mortality from a disease.

For comparison with the Baltimore data, some of the data for England and Wales reported by Logan will be presented. In the British reports on social distribution, classification is based on occupational groups. According to the 1951 census, 3.3 percent of the male population aged 15 years and over falls into social class I (professional); 15.0 percent in class II (intermediate between I and III); 52.7 percent in class III (skilled); 16.2 percent in class

**Table 1. Number of deaths from various types of heart disease, by race and sex, Baltimore, 1949-51**

Type of heart disease <sup>1</sup>	White		Nonwhite		Total
	Male	Female	Male	Female	
Arteriosclerotic heart disease, including coronary disease (420)-----	3, 296	1, 987	389	236	5, 908
Other myocardial degeneration (422)-----	1, 194	1, 252	357	308	3, 111
Hypertensive disease with mention of heart disease (440-443)-----	999	1, 418	542	682	3, 641
Hypertensive disease without mention of heart disease (444-447)-----	74	84	62	65	285
All other types-----	592	595	196	176	1, 559
Total-----	6, 155	5, 336	1, 546	1, 467	14, 504

<sup>1</sup> Numbers in parentheses are category numbers of the International Statistical Classification of Diseases, Injuries, and Causes of Death, sixth revision of the International Lists, 1948.

IV (semiskilled); and 12.8 percent in class V (unskilled) (2, 3). Thus, the English social classes I and II are roughly comparable to the Baltimore socioeconomic fifth 5; social class III, to socioeconomic fifths 3 and 4; social class IV, to socioeconomic fifth 2; and social class V, to socioeconomic fifth 1. By presenting this information, I do not intend to imply that the two classifications are completely comparable; it merely gives some idea of their comparability with regard to the percentage of population in each class.

In making comparisons between sexes, races, and socioeconomic groups, differences in the age composition of the population in these groups must be taken into account. This can be done readily by the method of age adjustment commonly employed in routine vital statistics practice. For this study, the standard population used for age adjustment was the total population of Baltimore in 1950. The data presented for each sex, racial, and socioeconomic group are average annual age-adjusted death rates and are therefore directly comparable.

In the British reports, an indirect method of age adjustment resulting in an index termed the standardized mortality ratio was used. Since this method differs from the one used to describe the Baltimore experience, the results cannot be directly compared in absolute terms. However, comparisons can be made between the social classes within each of the two geographic areas, and it is with such comparisons that we are concerned. The interested reader is referred to the text on medical statistics by Bradford Hill, where these methods of age adjustment are discussed (6).

### Arteriosclerotic Heart Disease

The International List category designated arteriosclerotic heart disease includes three subcategories: arteriosclerotic heart disease, coronary artery disease, and angina pectoris. All heart disease deaths in which coronary artery disease is mentioned are placed in this category, but, admittedly, deaths not due to coronary disease are also included. This category was used as representing deaths from coronary disease in the analysis of mortality in England and Wales in 1949 and 1950. It would appear

**Table 2. Average annual age-adjusted death rates per 10,000 population for arteriosclerotic heart disease (including coronary disease)<sup>1</sup> by race, sex, and socioeconomic status, Baltimore, 1949-51**

Socioeconomic fifth	White		Nonwhite	
	Male	Female	Male	Female
1 (lowest)-----	29.2	15.9	20.7	11.4
2-----	34.6	14.7	14.4	7.4
3-----	33.0	12.1	15.2	9.1
4-----	29.9	14.0	<sup>2</sup> 17.5	<sup>2</sup> 14.1
5 (highest)-----	32.3	13.0	<sup>2</sup> 24.8	<sup>2</sup> 9.1

<sup>1</sup> International List No. 420.

<sup>2</sup> Based on population of less than 1,000.

reasonable to assume that if there are significant racial, sex, or socioeconomic variations in mortality from coronary disease, it would be possible to detect them by an analysis of this category of deaths, unless, of course, the distributions of each subcategory are in opposite directions.

The results of the analysis of mortality from arteriosclerotic heart disease in Baltimore are presented in table 2. It is to be noted that males have markedly higher death rates than females, in both racial groups and in all socioeconomic groups. But perhaps of more interest is the fact that there is no particular pattern of variation in mortality for the different socioeconomic groups; the differences between socioeconomic groups may well be due to chance variation.

The lack of a socioeconomic pattern in Baltimore is in marked contrast to the findings

**Table 3. Standardized mortality ratios deaths from coronary heart disease for males and married females aged 20-64 years, social class, England and Wales, 1950<sup>1</sup>**

Social class	Male	Married females
I—Professional-----	150	
II—Intermediate between I and III-----	110	
III—Skilled workers-----	104	
IV—Semiskilled workers-----	79	
V—Unskilled workers-----	89	

<sup>1</sup> From reference 2.

social class distribution in England and Wales in 1950, which are shown in table 3. In England and Wales, there is an increasing gradient of mortality ratios from the lowest class to the highest among men, and there is a slightly increasing gradient in the reverse direction among married women. Admittedly, the Baltimore and the English data are not strictly comparable. The methods of classifying socioeconomic status differ, and the English data are limited to age groups 20-64 years. (The data for persons aged 65 and over are not presented here because they are expressed as proportionate mortality ratios.) Also, there are differences in the reporting and classification of causes of death: For example, in England the term "arteriosclerotic heart disease" is infrequently used in reporting causes of death. Nonetheless, it seems reasonable to expect that if social class variations in mortality from coronary disease did exist in Baltimore as

**Table 4. Average annual age-adjusted death rates per 10,000 population for other myocardial degeneration,<sup>1</sup> by race, sex, and socioeconomic status, Baltimore, 1949-51**

Socioeconomic fifth	White		Nonwhite	
	Male	Female	Male	Female
1 (lowest)-----	20.1	12.8	22.5	16.9
2-----	13.5	10.9	13.3	14.2
3-----	12.7	9.4	13.7	12.1
4-----	9.3	7.2	11.7	11.4
5 (highest)-----	8.4	7.1	6.2	4.3

<sup>1</sup> International List No. 422.

<sup>2</sup> Based on population of less than 1,000.

**Table 5. Standardized mortality ratios for deaths from myocardial degeneration for males and married females aged 20-64 years, by social class, England and Wales, 1950<sup>1</sup>**

Social class	Male	Married females
I—Professional-----	67	66
II—Intermediate between I and III-----	32	67
III—Skilled workers-----	97	98
IV—Semiskilled workers-----	98	120
V—Unskilled workers-----	137	134

<sup>1</sup> From reference 2.

**Table 6. Average annual age-adjusted death rates per 10,000 population for hypertension with and without mention of heart disease, by race, sex, and socioeconomic status, Baltimore, 1949-51**

Socioeconomic fifth	White		Nonwhite	
	Male	Female	Male	Female
With mention of heart disease <sup>1</sup>				
1 (lowest)-----	12.1	13.9	27.6	33.5
2-----	9.9	12.6	21.8	25.8
3-----	11.8	12.0	23.9	24.6
4-----	7.7	9.9	19.1	17.7
5 (highest)-----	9.0	7.7	22.0	21.6
Without mention of heart disease <sup>2</sup>				
1 (lowest)-----	0.7	0.6	1.9	3.3
2-----	.8	.9	1.7	1.8
3-----	.8	.7	2.9	2.2
4-----	.7	.6	3.0	1.3
5 (highest)-----	.7	.5	0	0

<sup>1</sup> International List Nos. 440-443.

<sup>2</sup> International List Nos. 444-447.

<sup>3</sup> Based on population of less than 1,000.

they appear to exist in England, they should have been evident in the data presented in this report.

### Myocardial Degeneration

The age-adjusted rates for deaths from other myocardial degeneration in Baltimore are presented in table 4. This category, according to the International List, includes such terms as fatty degeneration, myocardial degeneration with arteriosclerosis, cardiovascular degeneration, atheroma of heart or myocardium, and chronic myocarditis.

In general, the rates for white males are higher than the rates for white females, but there is little difference between the sexes for the nonwhite population. In addition, the white and nonwhite male rates are nearly the same. Thus, the nonwhite rates for both sexes are similar to the white male rates, and the white female rates are lower than the rates for the other three groups. This general pattern, which is present for all the socioeconomic groups, differs from that observed for deaths due to arteriosclerotic heart disease. The socio-



economic distribution also differs from that for arteriosclerotic heart disease. There is a decreasing gradient of mortality from the lowest socioeconomic group to the highest, for both races and both sexes.

The social distribution of mortality from myocardial degeneration in England and Wales in 1950 is shown in table 5. For this category of heart disease, the pattern is similar to that for Baltimore. This similarity perhaps increases the significance of the lack of consistency between the two areas with regard to coronary heart disease deaths. It would not seem that differences in the method of classification of social classes or the limitation to a certain age group would produce differences in the patterns of one group of deaths and not in the patterns of another.

### Hypertensive Disease

Classified in the International List under hypertensive disease are eight categories. For this report, these have been grouped into (a)

hypertension with mention of heart disease and (b) hypertension without mention of heart disease. The rates for these two groups are presented in table 6. Since there are only a few deaths classified in the second group, no conclusion can be drawn from the data.

For hypertensive disease with mention of heart disease, the rates for the nonwhites are about twice as high as the rates for the whites. This is true for both sexes and for all socioeconomic groups. The rates for the females are higher than the rates for the males in both racial groups. The higher white female rates are present in all socioeconomic groups except the highest group, where the male rate exceeds the female rate. Among the nonwhites, the female rate is higher than the male rate in the three lower socioeconomic groups, but a suggested reversal occurs in the two upper socioeconomic groups. This change in mortality relative to sex and social class, which occurs in both races, may be of some epidemiological interest and worthy of further investigation.

Table 7. Average annual age-specific death rates per 10,000 population for arteriosclerotic heart disease (including coronary disease),<sup>1</sup> by race, sex, and socioeconomic status, Baltimore, 1949-51

Age group (years)	Male					Female				
	Socioeconomic fifth					Socioeconomic fifth				
	1 (lowest)	2	3	4	5 (highest)	1 (lowest)	2	3	4	5 (highest)
White										
Under 25-----	0	0	0	0	0	0	0	0	0	0
25-34-----	1.0	.8	1.6	.7	.2	.3	.4	.3	0	0
35-44-----	10.5	13.4	7.6	9.6	9.2	1.3	1.0	1.1	.7	.4
45-54-----	51.2	38.9	39.7	43.9	36.8	9.7	8.9	7.8	6.4	5.5
55-64-----	101.9	100.2	112.1	109.7	93.5	42.8	41.4	34.2	27.2	27.0
65-74-----	151.7	212.8	183.8	114.2	203.5	108.5	85.8	102.2	69.2	100.2
75 and over-----	190.1	354.6	334.5	332.0	346.9	233.0	243.1	120.7	268.7	219.7
Nonwhite										
Under 25-----	2.0	0	0	0	2.0	0	0	0	0	2.0
25-34-----	0	0	7.6	2.0	2.0	0	2.6	1.6	2.0	2.0
35-44-----	32.3	9.3	16.8	2.0	2.0	131.6	10.0	1.5	11.9	2.0
45-54-----	60.4	75.1	71.4	2.0	2.0	59.5	46.2	35.1	39.0	2.0
55-64-----	240.3	169.0	134.8	2.0	2.0	161.3	136.4	98.0	94.6	2.0
65-74-----	233.8	244.1	293.0	2.0	2.0	199.6	97.3	146.6	289.9	2.0
75 and over-----	471.0	219.2	260.2	2.0	2.0	1,500.0	213.3	161.3	282.4	2.0

<sup>1</sup> International List No. 420.

<sup>2</sup> Based on population of less than 1,000.

It seems that the lower socioeconomic groups have a higher mortality from hypertensive disease (with mention of heart disease) than the upper groups, and, among females of both races, there is a suggestion of a decreasing gradient from the lowest socioeconomic group to the highest. This pattern can be considered as suggestive only, particularly since it is not clearcut for the males of either race.

## Other Results

In view of the differences between the Baltimore and the English experiences with regard to coronary disease deaths, I thought that perhaps the method of age adjustment might be concealing existing differences between social classes. For a better comparison of the mortality in the various social groups, age-specific death rates for three categories of heart disease are presented in tables 7 through 9. Examination of these rates confirms the existence of the patterns noted in the analysis of the age-adjusted rates.

The deaths classified in the remaining heart disease categories in the International List were grouped together, and the age-adjusted rates are presented in table 10. Owing to the heterogeneity of this group, no inferences can be drawn. Unfortunately, no one form of heart disease in this group could be singled out for further study because of the small number of deaths.

## Discussion

Before discussing the inferences that can be derived from the results of this analysis, attention should be directed to some of the limitations of the data. Of prime importance is the question of the accuracy of cause-of-death statements on death certificates. Recently, James, Patton, and Heslin reported an "appreciable degree" of inaccuracy when the causes of death on death certificates were compared with autopsy findings (?). The possibility of inaccuracy in cause-of-death statements imposes a serious limitation on what can be inferred from

Table 8. Average annual age-specific death rates per 10,000 population for other myocardial degeneration,<sup>1</sup> by race, sex, and socioeconomic status, Baltimore, 1949-51

Age group (years)	Male					Female				
	Socioeconomic fifth					Socioeconomic fifth				
	1 (lowest)	2	3	4	5 (highest)	1 (lowest)	2	3	4	5 (highest)
White										
Under 25.....	0	0	0	0	0	0	0	0	0	0
25-34.....	0	0	0	0	0	0	0	0	0	0
35-44.....	.8	.5	1.4	.5	.2	.4	.5	.4	.5	.6
45-54.....	10.9	2.9	8.4	1.4	2.4	4.0	2.4	2.5	1.6	1.2
55-64.....	41.0	31.0	19.4	17.2	8.9	23.1	11.5	11.8	5.1	5.1
65-74.....	125.4	77.4	77.4	43.3	52.5	56.4	52.5	42.4	34.2	31.0
75 and over.....	395.6	297.0	264.2	247.1	214.9	337.8	315.7	268.5	220.4	222.4
Nonwhite										
Under 25.....	0	1.7	2.7	0	2 0	0	1.4	0	0	2 0
25-34.....	0	1.4	0	2 13.1	2 0	1.4	0	0	2 0	2 0
35-44.....	10.2	6.2	6.3	2 0	2 0	14.9	10.5	4.0	2 0	2 0
45-54.....	78.2	48.0	62.5	2 57.6	2 0	41.1	17.5	47.9	2 15.8	2 0
55-64.....	240.3	88.5	99.7	2 105.0	2 0	160.0	119.2	133.6	2 122.0	2 0
65-74.....	2 451.2	286.2	2 293.0	2 235.3	363.6	2 354.8	215.4	199.6	2 144.9	2 129.9
75 and over.....	2 797.1	2 438.4	2 334.6	2 196.0	2 0	2 453.3	2 383.1	2 352.9	2 645.2	2 291.1

<sup>1</sup> International List No. 422.

<sup>2</sup> Based on population of less than 1,000.

Table 9. Average annual age-specific death rates per 10,000 population for hypertension with mention of heart disease,<sup>1</sup> by race, sex, and socioeconomic status, Baltimore, 1949-51

Age group (years)	Male					Female				
	Socioeconomic fifth					Socioeconomic fifth				
	1 (lowest)	2	3	4	5 (highest)	1 (lowest)	2	3	4	5 (highest)
White										
Under 25.....	0.1	0	0	0.1	0	0	0	0	0	0
25-34.....	.3	.4	0	.2	0	0	.3	0	.3	0
35-44.....	1.6	1.9	1.1	1.2	.9	2.6	4.3	.4	1.4	.6
45-54.....	9.4	7.4	9.3	7.8	6.2	15.4	10.1	10.2	7.4	4.5
55-64.....	31.1	32.6	25.7	19.2	22.2	31.6	26.1	34.8	23.1	15.6
65-74.....	87.2	62.9	73.1	39.8	61.4	79.2	79.4	66.6	59.7	47.0
75 and over.....	156.4	115.2	188.3	127.4	135.7	220.0	191.8	191.0	167.5	149.2
Nonwhite										
Under 25.....	0	0	2.7	0	2 0	0	0	0	0	2 0
25-34.....	8.0	5.5	0	2 0	2 0	5.5	5.1	8.1	2 11.3	2 0
35-44.....	35.7	21.8	14.7	2 81.7	2 0	51.4	49.4	33.6	3 25.5	2 52.4
45-54.....	120.7	68.9	89.3	2 57.6	2 0	171.9	135.9	125.8	2 47.5	2 42.4
55-64.....	299.2	257.6	193.4	2 210.0	2 80.7	326.2	289.5	239.3	2 219.5	2 0
65-74.....	2 346.3	370.4	2 512.8	2 117.7	2 727.3	2 510.0	354.4	389.7	2 289.9	2 259.7
75 and over.....	2 760.9	2 493.2	2 632.0	2 588.2	2 1,000.0	2 693.3	2 362.9	2 470.6	2 322.6	2 1,764.7

<sup>1</sup> International List Nos. 440-443.      <sup>2</sup> Based on population of less than 1,000.

the analysis of mortality data. But analysis of death certificate information is a readily available, inexpensive means of studying distributions of certain diseases, and it is generally considered a satisfactory method of uncovering areas for further investigation. Another limitation, as already pointed out, results from the use of census tracts as a means of socioeconomic classification.

The initial interest in this analysis was to determine whether the social pattern of coronary disease mortality observed in England and Wales might be due to differences in diagnostic practices in the various social classes. It seemed that this might be inferred if a similar pattern were observed in Baltimore and if a combination of the deaths from coronary disease and other myocardial degeneration should result in a disappearance of the social differential. But the distribution of coronary disease deaths was not found to be like the English pattern. If the two categories were combined, the highest socioeconomic fifth would

have the lowest rates, and there would be an increase in the mortality risk with a decrease in socioeconomic status. On the other hand, a reviewer of this paper has shown that when the English data for these two categories are combined, the highest social class still has the highest rates, although the difference between social classes is diminished.

Table 10. Average annual age-adjusted death rates per 10,000 population for all other forms of heart disease, by race, sex, and socioeconomic status, Baltimore, 1949-51

Socioeconomic fifth	White		Nonwhite	
	Male	Female	Male	Female
1 (lowest)-----	7.0	5.5	14.3	7.2
2 -----	6.7	5.5	12.3	6.7
3 -----	6.3	4.2	13.8	6.6
4 -----	4.6	3.8	1 15.6	1 4.8
5 (highest)-----	4.9	4.0	1 8.5	1 12.7

<sup>1</sup> Based on population of less than 1,000.

To explain the discrepancies between the Baltimore and English experiences, one is tempted to postulate the existence of possible biological differences. For example, from the viewpoint of a dietary hypothesis of coronary heart disease, it is conceivable that there may be differences in dietary habits among the social classes in England that do not exist in Baltimore. But before hypothesizing this type of explanation, it would be necessary to eliminate the possible influence of nonbiological differences, such as methods of social classification and of death certification and diagnostic practices.

The present analysis also raises the question as to whether the pattern observed in England and Wales can be used as a test of the consistency of any particular etiological hypothesis of coronary disease with the social distribution of mortality from this disease. If the social distributions were found to be similar in many geographic areas, the confidence with which these distributions could be used as an index of the validity of an etiological hypothesis would be increased. The apparent existence of dissimilar distributions in Baltimore and in England and Wales suggests the need for further investigation of social variations in heart disease mortality.

### Summary

From information on certified deaths in Baltimore during the period 1949 through 1951, mortality from various types of heart disease was analyzed by race, sex, and socioeconomic status.

Mortality rates for arteriosclerotic heart disease (including coronary artery disease) were observed to be higher among males than among females and higher in the white population than in the nonwhite. No significant differences were noted in the rates for five socioeconomic groups. This latter observation is in contrast to the social distribution found in England and Wales, where the risk of dying from coronary disease is highest in the upper social classes.

Mortality rates for myocardial degeneration were higher among white males than among

white females. Among the nonwhites, no essential differences were noted between the sexes. The rates for the nonwhites were somewhat higher than those for the whites. For both sexes and both races, the highest rates were noted in the lowest socioeconomic group, with a gradual decrease in rates with an increase in socioeconomic status. This social distribution is similar to that observed in England and Wales.

Mortality rates for hypertensive disease were higher in the nonwhite population than in the white. The lowest socioeconomic group had the highest rates, and there tended to be a decrease in rates with an increase in socioeconomic status, although the pattern was not regular. The female rates were higher than the male rates in the lower socioeconomic groups, whereas the reverse was true in the upper groups; this was observed for both races.

The use of death certificate information for analysis of mortality and the use of census tracts for socioeconomic classification both impose certain limitations on the data derived. Nonetheless, the apparent existence of differences in the social distribution of coronary disease deaths in two geographic areas indicates a need for further study of the subject.

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*The epidemiology of the septic tank is described with suggestions for helping builders of mass housing to prevent future disease outbreaks and nuisances.*

## Sewage Disposal in Mass Building

By DAVID B. LEE, M.S. in Eng.

**I**N the past 10 years, the urban fringe has seen the installation of millions of septic tanks, far more than had been eliminated by sanitary engineering services in the previous 50 years.

The septic tank has been installed not only for those who have land and income generous enough to accommodate and maintain the facility, but for families who have neither the space nor the resources to prevent the development of a sanitary nuisance and a public health hazard. Often such families must go to the expense of a new installation or, if possible, thorough reconstruction. Septic tanks may work well in rural areas if people do not live too close to each other or use a great deal of water for bathing, laundry, air conditioning, and dishwashing.

To put it simply, a septic tank is a country cousin that came to town and promptly got into trouble. In its place—a rural setting—the septic tank and subsurface drain field is a suitable method of domestic sewage disposal, given adequate drainage, soil conditions, and water table; but it was never intended for use in settlements with more than one family dwelling per acre. Even this may be too dense for septic tanks if soil conditions and water tables are not ideal.

Where public facilities cannot be arranged,

the septic tank soil absorption system of sewage disposal, originally designed for rural areas, is now widely utilized as a convenient and temporary substitute. Under rural conditions and with proper design, construction, and maintenance, this system will usually give some degree of satisfactory performance.

If failure of the soil absorption system occurs under rural conditions, the danger to public health is minimum since there are plentiful opportunities to choose another location for a new system. In urban areas, the septic tank is often a needless and frequently an extravagant method of sewage disposal which threatens to be a sanitary nuisance and a public health hazard to millions of homeowners.

Then, why have there been so many septic tanks installed during the past 10 years?

The following discussion will attempt to explain why builders adopt these expedient but short-sighted construction methods and to suggest what may be done about it.

The epidemiology of the septic tank itself suggests therapeutic and preventive measures for this form of community sickness, a sickness that is appraised not only by the number of individual infections but by nuisance, expense, and disorder. It is the business of public health to treat the community as the physician treats the person. And in view of the prospect of the continuing building boom, it is the business of public health to assure that this community sickness will not prevent or stunt healthy community growth.

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*Mr. Lee is director of the bureau of sanitary engineering, Florida State Board of Health, Jacksonville, Fla.*

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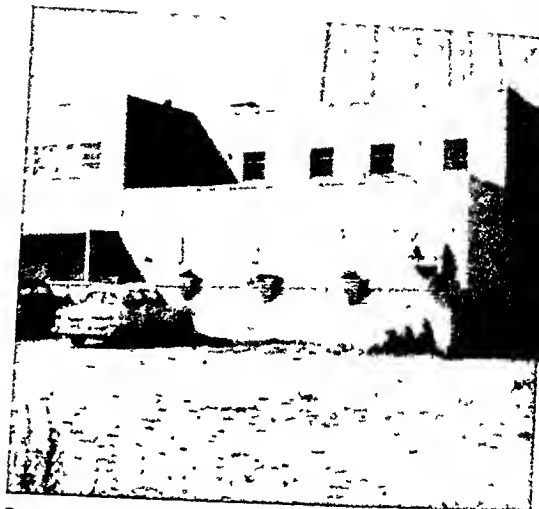
## Builders Are Human

In my judgment, the postwar building program is yet to reach its peak in many areas of the country. The housing deficit, accumulated since 1926, has been overcome only in isolated communities and for isolated income groups. Much of the housing built since 1940 has been only a temporary palliative to housing needs. Millions of units, fundamentally well-built and well-equipped, are already too small for growing families. With rising incomes, families are demanding more of housing. If you add to these factors the steady obsolescence of aging buildings, spatial shifts of population, and the rising birth rate, it is apparent that the current production rate of 1.3 million dwelling units a year is not excessive.

Accurate figures are not available, but in my opinion the estimate that at least 24 million persons in the United States are served by 6 million individual septic tank systems is close to the truth. More important, however, is the estimate that more than one-third of the new homes now being constructed will have septic tank systems for sewage disposal. All of this continues against the better judgment of many in the public health profession, and presents one of the greatest challenges sanitary engineers and other public health workers will have to face in the years to come. Must we abet septic tanks?

The mass building industry is chronically in need of land, low-priced land, in large tracts. Such land is seldom to be found within city limits, where zoning laws and city plans apply, and where community water and sewerage facilities are likely to be present or required.

Mass builders usually find the land they need in territory where inhabitants or governing authorities have had meager or limited experience in urban development. It is unlikely that in such an area there is any local person equipped to supervise the builders and their sewage disposal plans. The burden of supervision usually falls on the county and State officials and, in some instances, on the insuring and lending agencies. Even so, in the interest of profit and sound construction, progressive mass builders would prefer to put in community water and



Serving several subdivisions, this activated sludge plant houses two primary mechanical aerator units, a sludge digester, laboratory, pump room, office, and truck loading room for digested sludge. The slump brick terrace (lower terrace) is a chlorine contact chamber and the higher terrace (second floor level) is a secondary clarifier.

sewerage facilities. What stands between them and their better judgment is a matter of money.

Typically, a builder does not construct 200 houses wholesale and then sell them in one lot. In phase building, he finishes one house at a time. And he sells one at a time, as the units are finished. Even if his sales are committed in advance, settlement of the title is closed only as the individual houses are finished.

Naturally, he wishes to recover water and sewerage installation costs on each house as it is sold. Such recovery is easiest when the house has a private well and septic tank.

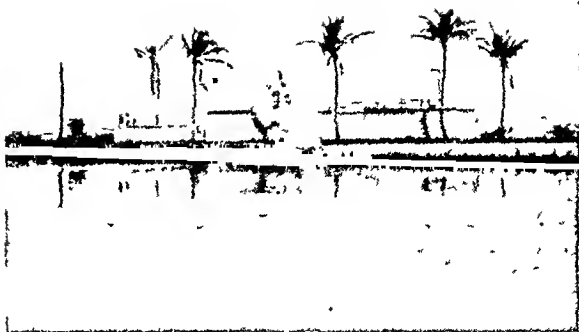
It is not as easy to recapture the investment in community facilities with any rapidity. To provide community sewerage facilities for no more than 500 units would tie up between \$150,000 and \$200,000 while the houses are in construction. It may take a little time before this investment can be freed. There have been few, if any, financial institutions willing to carry that kind of investment, especially for builders who may sell no more than 30 to 100 houses a year. Such financing is certainly not practical for the typical builder who needs a fast turnover on limited capital simply to keep himself going. Even mass builders are susceptible to the appeal of the fast return of their

money. Some have ventured to use septic tanks with projects of as many as 8,000 homes and larger.

### The Cost of Services

Given financing, it would be to the great advantage of both the builder and the community to install community water and sewerage facilities. To deal with sewage disposal alone, the Florida builder can install sewers at a charge ranging from \$150 to \$250 per lot. To include the cost of sewage treatment facilities for 500 families in my own State would run the total charge for sewage disposal facilities to from \$300 to \$400 a dwelling.

The superior attraction of a house with sewerage connections will enhance the market value of the structure by some amount over and above the ordinary charge for septic tank installations. Although the increased value of the house may return a price that will pay for the community sewage collection and treatment facilities, title to the plant would remain with the builder. Furthermore, by collecting sewage service charges, he may cover operating, maintenance, and amortization costs, and so recover his investment. Meanwhile, the community would have the advantage of a trouble-free waste disposal system. The gross income from 500 houses with community water supply and



**Carol City activated sludge plant as seen from across the manmade lake into which the effluent discharges.**

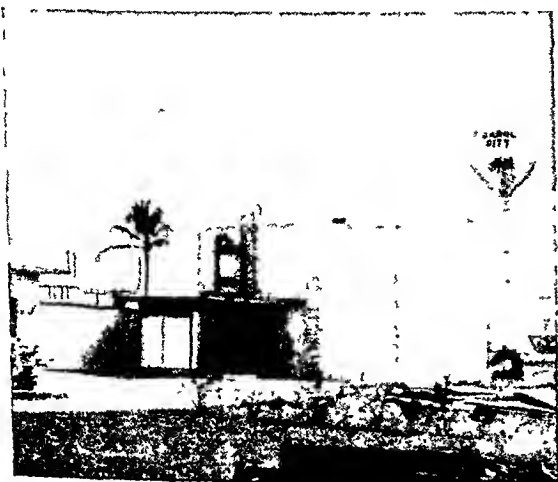
community sewerage may amount to approximately \$30,000 a year. Such an operation is practical with as few as 200 houses.

Recognizing such financial advantages, 120 subdivisions in Florida have installed their own community sewage disposal facilities and community water systems in the past 5 years. But several were motivated also by a stern refusal by government officials to permit septic tank construction in areas where such disposal methods are no longer suitable.

It can often be demonstrated that the average cost of a septic tank and subsurface disposal system and the cost of maintaining and operating such a system are certainly equal to, and, in many cases, more expensive than a monthly sewer service charge for a method of sewage disposal that is not only safe but trouble free.

### Corrective Measures

Once septic tanks are in, especially in areas with a high water table, poor soil conditions, and relatively dense settlement, the corrective measures frequently require that they be bypassed. They may serve well during dry periods but let the rains come and in no time the soil is saturated: From the ground surface noxious gases will come forth; septic tank effluents will appear on the ground; they may



**Aeration tank and public water supply tank in the background with the sludge digester and control house in the foreground serving Carol City, Fla., near Miami.**

back up into bath tubs or prevent the flushing of commodes.

As this was written, on January 24, 1956, two ladies called me to report that more than 100 septic tanks in their subdivision had failed in the past 24 hours. The gases coming back through the plumbing and into the house were so serious that the house had to be opened and the attic fan used to freshen the air. This was besides the fact that the yard was flooded with septic tank effluent.

In one subdivision with 180 homes of a high financial bracket, soil conditions were such during 1955 that 25 homeowners were obliged to construct relief sewers from their drain field to the roadside ditch in order to allow the wastes to escape.

Since sewerage is the only practical correction for defective septic tank installation, it seems obvious that in mass building projects sewers should be installed when the homes are built.

We, in Florida, recommend that plumbing in all new houses be so constructed and septic tanks, when used, be so located—on the side of the house or in the front—as to facilitate eventual connection to a sanitary sewer.

### Preventive Measures

What can be done to assure that mass housing projects of the future will be built with adequate community sewerage facilities?

Of all possible means of preventing undesirable septic tank construction in the future, aggressive, direct efforts by government officials, by builders, and by insuring and financing agencies are most likely to produce results. Governments and political subdivisions can strive to overcome artificial political barriers which today strangle rational urban growth, and which, in fact, encourage undesirable building in outlying areas at the expense of well-established urban centers. Whether it is done by creating sanitary districts, metropolitan or regional planning authorities, county and State zoning officials, new boundaries, or local government holding companies, the accommodation of urban growth is a primary political responsibility of local and State governments.

If local and State governments impart such

political muscle to zoning and planning commissions, it cannot be too heavily stressed that members of such commissions should be independent of financial pressure and political and special interests. Commissions should be staffed by qualified and intelligent laymen as well as professional personnel with merit system status. They should also be sensitive to the welfare of the people and be interested only in the development of the area they serve and the part it plays in the development of the State and the Nation.

The most immediate opportunity for good work in urban growth, however, is in the hands of agencies which insure, guarantee, or underwrite funds for residential construction and development. It would be to their own interest and protection to assure loans for community water and sewerage facilities and to require such systems for all dwellers whose financing they insure in mass building developments. If these agencies would do no more than agree to insure mortgages on community facilities, builders, the financial people, sanitary engineers, and others will certainly work out the details. In my opinion, the greatest need in housing today is for leadership in the financing of community water and sewerage facilities.

### Summing Up

Based on my experience, it has been demonstrated that the septic tank in congested neighborhoods is uneconomic, unwise, and unwholesome. Its widespread use in recent years may be due largely to the failure of local government officials to assure wise and orderly development of new neighborhoods and to the failure of financial institutions to encourage builders to install community sewerage facilities. Since sewerage facilities are the only practical alternative to the use of septic tanks, their construction must be encouraged if we are to avert the installation of millions of septic tanks in the next 10 years. All government agencies need to organize better methods of managing urban and suburban growth. But immediate benefits will result from agreements by insuring and lending agencies to finance community facilities for water supply and sewage collection and treatment.



# 50 years — of Food and Drug Protection



By **GEORGE P. LARRICK**

*Commissioner of Food and Drugs*

This section of *Public Health Reports* is devoted to an account of some of the principal programs of the Food and Drug Administration which affect public health.

It is an appropriate way to commemorate the golden anniversary of our first Federal pure food and drug law, not so much by reviewing the past as by considering the challenge of the future.

The articles are by men directly concerned with the administration of the programs. It is notable that they consistently emphasize technological changes in foods, drugs, and cosmetics, affecting an important part of the human environment.

From the beginning the food and drug law has been directed at specific abuses: errors of omission or commission which can be proved in a court of law. Likewise, the law has from its beginning reflected the standard of achievement attained by the majority of producers of foods and drugs and has required the backward element to meet that same standard.

As a result, food and drug law enforcement has been a stimulus to industrial progress as well as a direct and practical means for dealing with important environmental health hazards.

The original Pure Food and Drugs Act which Theodore Roosevelt signed into law on June 30, 1906, was one of the great milestones of public health progress. Few, if any, events have had a greater effect in promoting such objectives as the sanitary handling of food or rational therapeutics in medicine. It would be fitting to dedicate these papers to Dr. Harvey W. Wiley, who, more than any other, was responsible for the enactment of this law.

Each generation needs to learn anew the why and wherefore of its institutions and blessings; otherwise they are taken for granted. Today, the right of the public to pure foods, effective drugs, safe cosmetics, and truthful labels has become generally accepted. It was not always so. We need to be reminded of Dr. Wiley and his 23-year struggle to obtain our first Federal pure food and drug law. It helps us understand and appreciate the value of the protective laws we now have, and the truly wonderful progress made by our food, drug, and cosmetic industries in this half century. It also helps us understand our problems of today and our obligation to insure that food and drug products of today and tomorrow will continue to be the best in the world.

# Significant Dates in Food and Drug Law History

Since the beginning of recorded history, men who have organized themselves into civilized societies have been concerned about the purity of the food and drink offered to the public.

In 1202, King John of England proclaimed the first English food law, the Assize of Bread. This prohibited adulteration of bread with such ingredients as ground peas or beans.

The history of food and drug measures as it has developed in the United States is set forth in the following chronology:

**1784.** Enactment by Massachusetts of the first general food law in the United States.

**1824.** Flour Inspection Act for Alexandria, then in the District of Columbia.

**1844.** Dr. Harvey Washington Wiley was born October 18 at Kent, Ind.

**1848.** Edwards law passed to prohibit the importation of adulterated drugs.

**1850.** A pure food and drink law was passed in California, one year after the gold rush.

**1879-1906.** During these 27 years more than 100 food and drug acts were introduced in Congress.

**1879.** Chief Chemist Peter Collier, Division of Chemistry, Department of Agriculture, began a food and drug adulteration investigation.

**1880.** Peter Collier recommended enactment of a national food and drug law.

**1883.** Dr. Wiley became chief chemist of the Division of Chemistry of the Department of Agriculture on April 9. Immediately he assigned some members of his staff to study the problems of food and drug adulteration.

**1883.** The Tea Importation Act was passed, providing for inspection of all tea entering United States ports.

**1890.** Acts were passed prohibiting importation of adulterated food and drugs and providing for certification of certain exported meat products.

**1891-1895.** Partial protection of domestic consumers was effected by acts requiring inspection of animals for diseases before slaughtering.

**1902.** Sherman Act, passed by Congress on July 1, prohibited the false branding of food and dairy products. In this same year appropriations were made by Congress to establish pure food standards.

**1906.** The first Federal Food and Drugs Act (34 stat. 768), the Heyburn Act, passed Congress and was signed June 30 by President Theodore Roosevelt. The President also signed the Meat Inspection Act on that day.

**1907, January 1.** The Bureau of Chemistry of the Department of Agriculture, headed by Dr. Wiley, began administration of the Food and Drugs Act of 1906.

**1912, March-December.** Dr. Wiley was succeeded by Dr. Carl L. Alsberg as chief chemist of the Department of Agriculture. Regulatory and research functions were separated.

**1913, March 3.** Gould amendment (37 stat. 732), requiring that quantity information on food packages be correct, passed.

**1919, July 24.** Kenyon amendment (41 stat. 271) passed. It applied net-weight labeling to wrapped meats.

**1921, July.** Dr. Alsberg was succeeded by Walter G. Campbell, who became acting chief of the Bureau of Chemistry.

**1924, July.** Mr. Campbell took over all regulatory work of the Bureau of Chemistry as a separate function, as Dr. Charles A. Browne became chief of the Bureau.

**1927.** A separate law-enforcement agency was formed, first known as the Food, Drug, and Insecticide Administration; then, in 1931, as the Food and Drug Administration. Mr. Campbell became Commissioner of Food and Drugs.

**1930.** The canning industry supported the McNary-Mapes amendment, authorizing standards of quality and fill of container for canned foods.

**1938.** The Copeland bill was passed by Congress. It was known as the Food, Drug, and Cosmetic Act of 1938, and contained these new provisions, among others:

Extended coverage to cosmetics and devices.

Required predistribution clearance of safety on new drugs.

Prohibited addition of poisonous or deleterious substances to foods, except where required or unavoidable.

Provided for tolerances for unavoidable or required poisonous substances.

Authorized standards of identity, quality, and fill of container for foods.

Authorized factory inspections.

Added the remedy of court injunction to previous remedies of seizure and prosecution.

**1940, July 1.** FDA transferred from the Department of Agriculture to the Federal Security Agency.

**1944, May 1.** Dr. Paul B. Dunbar succeeded Mr. Campbell as Commissioner of Food and Drugs.

1945, July 6. Federal act amended to require certification of the safety and efficacy of penicillin. Later amendments extended this requirement to other antibiotics.

1948, June 24. Miller amendment (62 stat. 582) affirmed United States jurisdiction over products adulterated or misbranded after interstate shipment.

1951, June 1. Charles W. Crawford succeeded Dr. Dunbar as Commissioner.

1951, October 26. Durham-Humphrey amendment (65 stat. 648) specifically required that drugs which cannot be safely used without medical supervision bear the pre-

scription legend on the label and be dispensed only upon prescription.

1953, August 7. Factory inspection amendment (67 stat. 476) clarified previous provision regarding mandatory factory inspection, and required the issuing to manufacturers of written reports on inspections and analysis of factory samples.

1954, April 15. Hale amendment (68 stat. 54) simplified method of promulgating food standards where no controversy was involved.

1954, August 12. George P. Larrick succeeded Mr. Crawford, who retired as Commissioner.

1955. Secretary Oveta Culp Hobby of the Department of Health, Education, and Welfare appointed a committee of 14 distinguished citizens to study the adequacy of the Food and Drug Administration's facilities and programs.

1955. The Citizens Advisory Committee reported on June 30, recommending a substantial expansion of FDA's facilities, a new building for FDA, and more use of educational and informational programs by FDA.

1956. The 50th anniversary year, a year of tribute and rededication on the part of government and industry to the cause of effective food and drug protection.



### THE BIRTHDAY SEAL

Adapted by the Association of Food and Drug Officials

# Food Sanitation

By GLENN G. SLOCUM, Ph.D.



In the first annual report of the Bureau of Chemistry, Department of Agriculture, after the passage of the Food and Drugs Act of 1906 (1), Dr. Harvey W. Wiley stated: "Any unfavorable conditions found in the factories inspected were subsequently discussed with the inspectors, with a view . . . of impressing upon them the necessity of sanitation in the preparation of articles of food and drugs . . ." Thus, food sanitation programs were initiated at the inception of enforcement of the first Federal food and drug law. They have continued for 50 years to occupy a prominent position in the work of the Food and Drug Administration.

The Food, Drug, and Cosmetic Act of 1938, like the act of 1906, is basically a statute to protect the public health. Proper sanitation in the production and handling of foods and drugs is one of its major requirements.

A sanitary food, strictly speaking, is one free from injurious substances, particularly infections micro-organisms. But modern concepts of food control have expanded this definition to include freedom from materials that are repulsive or obnoxious regardless of their importance as agents of disease. This development is an important factor in the protection of health, since many forms of food contamination carry potential health hazards that cannot be measured, even with modern analytical tech-

niques, by objective examination of food products. The expanded definition has become generally accepted by the food industries and the public, and it is firmly established by many court decisions in actions brought under the food and drug laws.

The requirements of the law and the objectives of the Food and Drug Administration with respect to food sanitation may be stated simply: that foods be prepared from clean, sound, and wholesome raw materials and that sanitary conditions prevail at all stages of production and distribution. It has been the consistent policy of the Food and Drug Administration through 50 years of enforcement of the food and drug laws to seek to improve the sanitary quality of the food supply by all means and facilities at its disposal.

## The Early Activities

When the Food and Drugs Act was enacted in 1906, interstate traffic in foods was limited primarily to a few staple products. Food production and distribution were largely local operations, and the housewife usually processed the basic raw materials in her home. Although Dr. Wiley and others supporting the drive for legislation were preoccupied with such problems as the use of harmful or potentially harmful chemicals in foods and widespread economic adulteration, writings of that period show that there was a real recognition of and concern with problems of food sanitation.

Early administrative reports of the Bureau of Chemistry, Department of Agriculture—the agency charged with enforcement of the Food

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and Drugs Act until the Food and Drug Administration was created in 1927—clearly trace the development of food sanitation programs (1). Sanitary requirements of the law were stressed in inspection of all food processing and distributing facilities. Field and laboratory investigations of sanitation were soon initiated for many important commodities, including milk, cream, ice cream, bottled mineral waters, shellfish, gelatin, poultry, and fresh, frozen, and dried eggs. Bacteriological and microscopic methods of analysis for detection of contamination and spoilage were developed and put into use. Research operations not only revealed enforcement problems and methods for the detection of contamination but also provided information to help industry avoid violations and improve the overall quality of the product. This educational approach, which has always been coordinated with enforcement of the legal requirements of the food and drug laws, is often unknown to those not fully conversant with the Food and Drug Administration's work.

One of the outstanding personalities in the early food sanitation programs was B. J. Howard, chief of the microchemical laboratory of the Bureau of Chemistry. His applications of the microscope to the detection of decomposed, filthy, or insanitary foods were a major contribution to improvement in the sanitary quality of foods in this country. For the development of a mold count method of detecting rot in tomato products, he received worldwide recognition.

Although the microbiological aspects of food sanitation were an important element of the early investigations, a separate microbiological laboratory was not created in the Bureau of Chemistry until 1913. Under the direction of Dr. Charles Thom, the noted mycologist, the laboratory continued and expanded investigations in food sanitation and spoilage and food poisoning. It was in this laboratory that Dr. Stewart Koser conducted his studies of the metabolism of coliform organisms. His findings form the basis today for distinguishing *Escherichia coli* from other members of this group. Research in food sanitation was further expanded under Dr. A. C. Hunter, who became director of the bacteriology laboratory

when the Food and Drug Administration was created in 1927. Drs. Thom and Hunter were authors of the book "Hygienic Fundamentals of Food Handling," published in 1924. It was one of the earliest books, if not the first, on this subject.

### Improvements in the Law

The Food and Drugs Act of 1906 defined a food as adulterated "if it consists, in whole or in part, of a filthy, decomposed, or putrid animal or vegetable substance . . ." This was the legal basis on which the food sanitation programs were founded. Although major improvements resulted from application of this requirement, there was early recognition of serious limitations of the law. This is best summed up by the following statement from the 1933 Report of the Food and Drug Administration by Walter G. Campbell (1):

"One of the most serious limitations of the present law, of especial moment where public health questions are involved, is the lack of control of insanitary practices in food-manufacturing plants. Jurisdiction under the Federal statute exists only after a product has been shipped or offered for shipment within the scope of the law. The detection of insanitary practices through inspection in the manufacture of food products does not give sufficient warrant for removing offending goods from interstate channels. To obtain evidence of contamination that will warrant a charge of adulteration within the meaning of the law, it is necessary to collect representative samples of the product and analyze them. This is by no means always an easy matter. Analytical methods have not been developed with that degree of refinement needful to establish in all instances evidences of insanitary handling of a product originating in an insanitary factory."

This important gap in the law was corrected in the Food, Drug, and Cosmetic Act of 1938. It defines food as adulterated—

"If it consists in whole or in part of any filthy, putrid, or decomposed substance, or if it is otherwise unfit for food; or

"If it has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or

whereby it may have been rendered injurious to health. . . ."

Other requirements of the 1938 law or its amendments made factory inspection mandatory and extended jurisdiction to articles adulterated while held for sale (whether or not the sale is the first one) after shipment in interstate commerce.

These changes gave the Food and Drug Administration legal authority to deal comprehensively with food sanitation.

### Enforcement Procedures

The 50 years of food law enforcement coincides with the period of vast expansion of the food industries. Increasingly, food production has moved to large factories which distribute products throughout the Nation. Often the products have been so altered in form that the consumer has little basis on which to judge their original cleanliness and wholesomeness. As the more obvious forms of adulteration disappeared, newer, more subtle forms became apparent. These have required development of new techniques for their detection.

To provide for the most effective and efficient use of the limited funds and facilities available to deal with the increasing needs for consumer protection, the project system of operations was introduced in 1922. In brief, this system consisted in the formulation of a comprehensive and unified plan of operations for the entire field force, directed against specific classes of products that experience had shown to be most likely to be in violation. Priorities were assigned for work allocations in the following order:

1. Violations involving danger to health.
2. Offenses against decency (insanitation, filth, and decomposition).
3. Economic adulteration.

The project system is the basic pattern for the regulatory programs of today, including the programs in food sanitation.

In order to determine the types, sources, and routes of transmission of contamination, a knowledge of methods of production, processing, packaging, and marketing is necessary. This information is obtained through broad investigations of an industry in various locali-

ties by inspectors of the field force, usually in collaboration with technical experts from the Washington headquarters. With this background, inspectional and laboratory techniques are devised, policy is determined, and a plan of action is issued for uniform application throughout the country.

The basic operation in a food sanitation program is the sanitary inspection of the factory. The likelihood that food may be polluted or contaminated with filth in the factory is in proportion to the distance between the filth and the product under preparation. The objective of the sanitary inspection is to measure this distance in terms of space, time, opportunity for pollution or contamination, and vehicles of transmission.

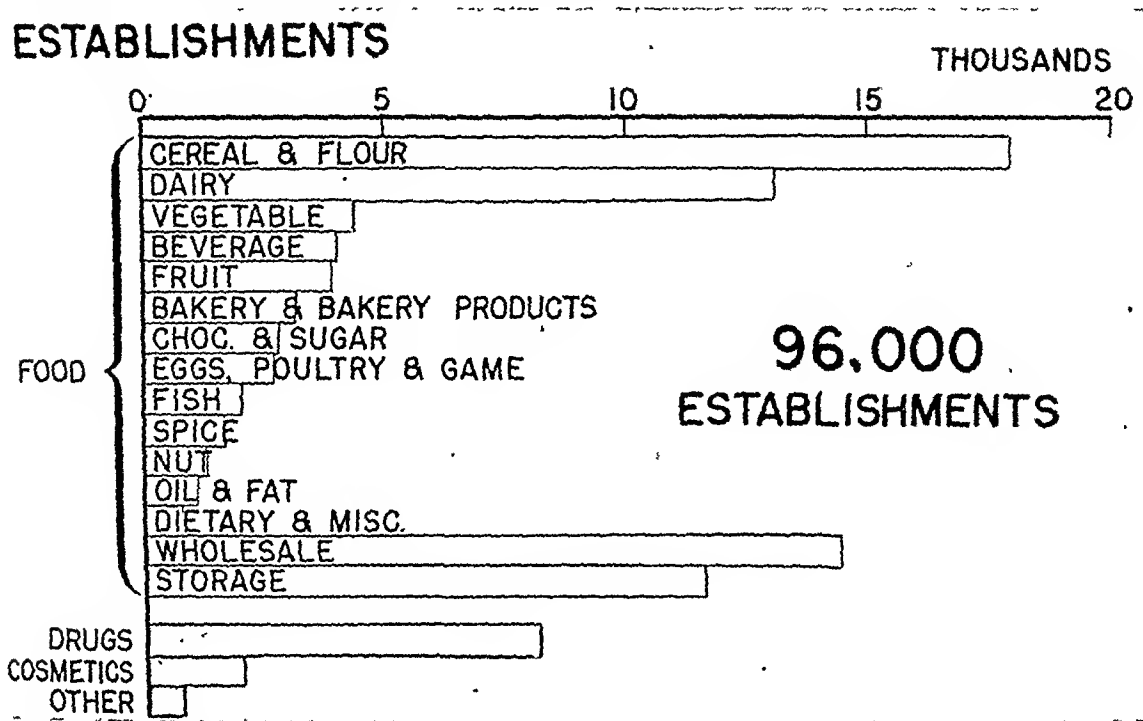
An establishment operating in a manner to invite, or permit, contamination of food with foreign matter properly classified as filth is insanitary. The objectionable matter may be the excreta of man or animal, or it may be flies, maggots, worms, insects or insect parts, rodent hairs, or other such material.

In many instances, the contaminants are macroscopic, and detection of the avenues of their entrance into food depends only on keen powers of observation and common sense. In other instances, the contaminants are micro-organisms or microscopic filth, and knowledge and appreciation of invisible routes of distribution are required.

Sanitary inspection evidence alone, presented in court by the inspector, often with pictures and exhibits demonstrating insanitary conditions, is sufficient to support a charge that the product "may have become contaminated with filth." Such action is essential in instances in which the objective evidence of even gross contamination has been removed or destroyed by such processes as filtration or pasteurization of the product. More commonly, however, insanitary conditions result in contamination that can be detected in the finished product by bacteriological or microscopic examination.

In practice, then, products shipped from an insanitary establishment are usually sampled in interstate commerce for laboratory analysis. The findings may confirm the inspection evidence of insanitation and establish the presence of filth in the product. Offending products

Figure 1. Establishments engaged in distribution of products subject to regulation by the Food and Drug Administration.



may be removed from the market through seizure by the Federal courts, and the shipper may be prosecuted for, or enjoined from, violating the sanitary requirements of the law.

### Voluntary Correction

Application of these techniques on an industrywide basis, within the limits of funds and facilities, exerts a strong corrective influence. Correction depends on education, and education is inherent in enforcement of the food sanitation requirements. The basic investigations essential to development of a food sanitation program are usually conducted widely in the affected industry. Methods developed to detect contamination are made available to industry for use in preventing contamination. The food and drug law now requires that the FDA inspector give to the agent in charge of the establishment a written report of conditions or practices that might lead to violations of the sanitary requirements of the law. Prior to this amendment, the inspectors discussed with management any such conditions so that voluntary corrective measures might be instituted.

The Food and Drug Administration also promotes voluntary compliance with the law by such means as talks to trade groups, surveys, consultations, and, whenever practicable, direct assistance in solving technical problems. Punitive action under the law then, falls largely on operators who are careless or who are unwilling to use the measures available to them to avoid violations.

It has been stated that the food and drug laws, and particularly the "insanitary conditions" clause in the definition of adulterated foods, have been major stimuli to improvement in food sanitation (2). Certainly this new provision focused attention on a phase of food handling not well attended to by some industries in the past. The response to this provision by the food industries has been gratifying. There are few trade associations or large operators in the food field that are not now active in programs to improve sanitation.

### Need for Expansion

Despite the progress that has been made, there is a serious need for expansion of all food

sanitation programs—national, State, and local. As shown in figure 1, there are some 96,000 establishments in this country distributing products subject to the Federal food and drug law, the vast majority of which are in the food field. In addition, food and drug imports are subject to the same requirements. There are sanitation problems of greater or lesser degree connected with all the food commodity groups listed. About 10 percent of the establishments can be inspected and about 7 percent of the imports can be sampled each year with the present staff (fig. 2).

The major food sanitation programs of the Food and Drug Administration have been concerned with certain cereal products, butter and cheese, certain fruit and vegetable products, bakery products, confectioneries, eggs, and certain fish products. Current emphasis is on edible oils and poultry. Many commodities within these groups and others in figure 1 have not received organized action with respect to sanitation.

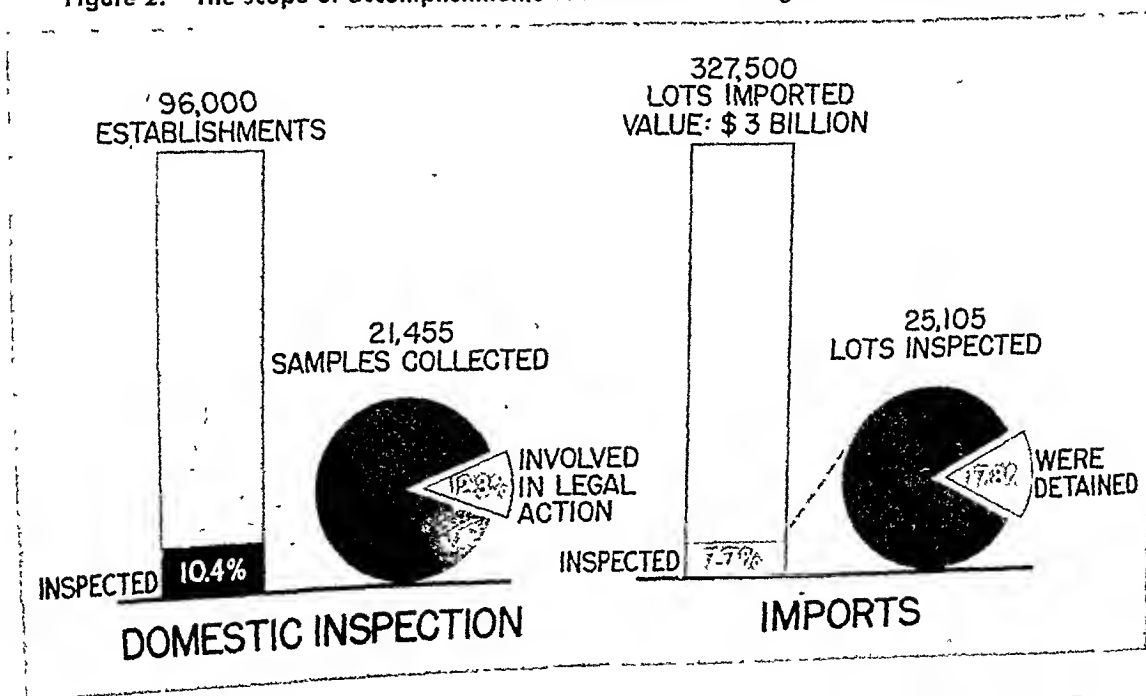
During fiscal year 1955, an average of about 75 tons a week of insect-infested, rodent-defiled, or decomposed food was seized under the food and drug law and removed from trade chan-

nels. More than four-fifths of all food seizures fall in these categories. Though a substantial proportion of the food becomes contaminated while it is in wholesale or storage warehouses apart from the point of production, too frequently contamination occurs during production.

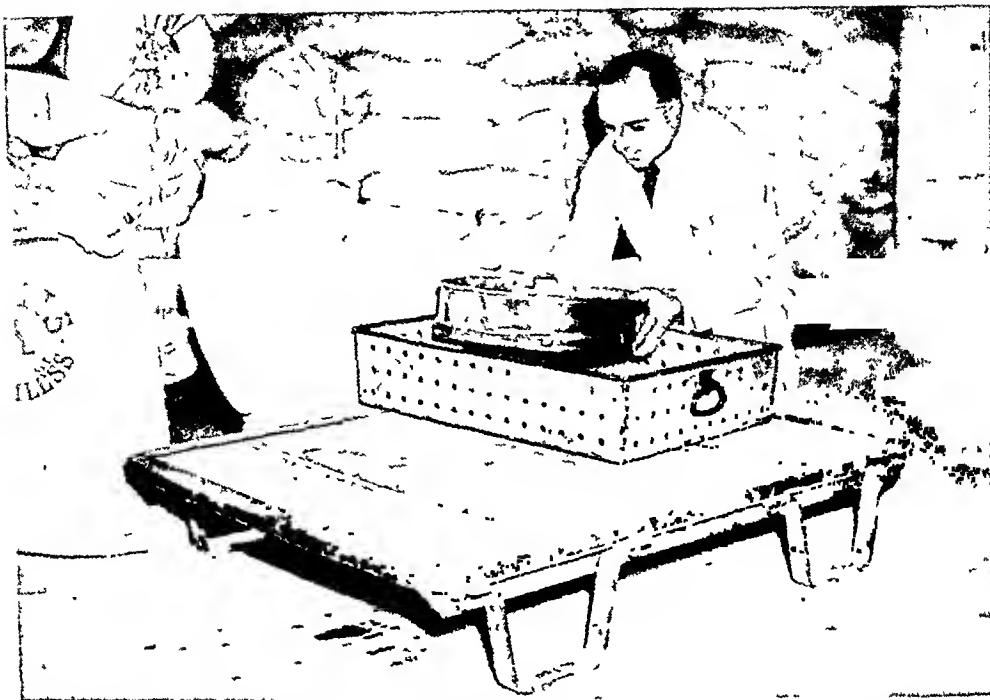
Much of the progress in food plant sanitation under FDA programs has been based on the elimination of the more obvious sources of contamination: insects and rodents. Inspection techniques for their detection are relatively simple, and laboratory procedures for the detection and isolation of insect and rodent filth in food have been available for the past 15 years. Emphasis on these factors has encouraged remarkable improvement in (a) surroundings, structure, maintenance, and operation of plants and equipment; (b) cleanliness and soundness, sorting and storing, of raw materials; and (c) plant and laboratory control of raw materials and finished products. It has led to the establishment of sanitary programs as an integral part of food production.

Except in those instances in which contamination with micro-organisms has resulted in clear evidence of danger to health, little has

**Figure 2. The scope of accomplishments of the Food and Drug Administration, fiscal 1954.**







**Bakery warehouse flour being examined by FDA inspector for insect infestation.**

been done, or can be done with the staff available, in the bacteriological aspects of food plant sanitation. Foodborne infections and intoxications have not decreased in recent years as have waterborne and milkborne diseases. Much of the foodborne disease probably results from mishandling at the point of consumption. But it may well be that there is more bacterial contamination of foods shipped in interstate commerce than is generally realized. Since the enteric infections transmitted by foods must be regarded essentially as evidence of fecal contamination, the importance of improved sanitation during all stages of food production and handling becomes apparent. A much enlarged complement of microbiologists in the FDA field offices is needed to meet the problems in this area.

The Food and Drug Administration has broad responsibility for the protection of the public against interstate traffic in insanitary foods. As new food products, increasingly in processed ready-to-eat forms, appear on the market, expansion of the Food and Drug Administration of the order recommended by the Citizens Advisory Committee will be neces-

sary to cope with the many new food sanitation problems (3).

Many foods, of course, are sold within the community or the State in which they are produced. Sometimes manufacturers having difficulties with the Food and Drug Administration purposefully restrict the distribution of their products to intrastate traffic. Sanitation of these foods is the problem of State and local officials.

Food sanitation, then, is the concern of State and local officials as well as national officials. The combined efforts of all are necessary to afford the degree of protection from insanitary food the consumer expects and is entitled to.

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- (2) Parker, M. E.: Food-plant sanitation. Ed. 1. New York, N. Y., McGraw-Hill, 1948.
- (3) Citizens Advisory Committee on the Food and Drug Administration: Report to the Secretary of Health, Education, and Welfare. House Document No. 227, 84th Cong., 1st sess. Washington, D. C., U. S. Government Printing Office, 1955.

# FDA Nutrition Program

By E. M. NELSON, Ph.D.



The passage of the Food and Drugs Act of 1906, prohibiting adulteration and misbranding of foods, accelerated a consideration of their nutritive value and the advancement of nutrition science. In the first few years of the new law, the adulteration of foods involving the use of poisonous or deleterious ingredients was of primary importance. Foods containing toxic dyes and preservatives were common examples. As adulterated foods of this kind were driven from the market, greater attention was given to so-called economic types of adulteration such as the substitution of non-nutritive fillers, water, or other cheap ingredients for the more valuable food ingredients which the customer expected to find in the foods he purchased.

The knowledge of nutrition in those years did not permit the critical evaluation of the effects of processing and other manufacturing procedures on the nutritive value of our food supply that is commonplace today.

Since 1906, the science of nutrition has advanced more rapidly than in any prior period of time. It was not until the early part of the century that laboratory animals were used in testing the nutritional adequacy of foods. The word "vitamin" was coined in 1911, but it was not until 1926 that products were examined for vitamin content. The isolation, identification, and synthesis of the major vitamins took place in the decade from 1930 to 1940 when the im-

portance of vitamins in our dietary was brought to the fore.

The enactment of the Food, Drug, and Cosmetic Act of 1938 reflected the progress that was being made in the field of nutrition and applied the new scientific knowledge to the protection of consumers. In addition to the basic adulteration and misbranding provisions of the Act of 1906, the 1938 law gave authority to establish legal standards for foods and thus provide for better control of the nutritive value of such products. It required more informative labeling of foods generally and authorized special labeling requirements for foods for special dietary uses.

The policies and regulatory actions of the Food and Drug Administration are designed to provide consumers with the benefits of practical application of reliable nutritional knowledge in the production and labeling of foods, and to prevent consumer exploitation by pseudo-nutritionists and other quacks.

A standard for a food under the Food, Drug, and Cosmetic Act must "promote honesty and fair dealing in the interest of consumers." Under this provision, consideration must be given to the effects of the kinds and amounts of ingredients permitted in a standardized food on its overall nutritional value. This has been of particular significance in considering proposals to add specific nutritive factors such as vitamins and minerals to staple foods.

## Fortification of Foods

The Food and Drug Administration has followed a policy that is intended to limit the addition of specific nutritive ingredients such as

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vitamins and minerals to standardized foods to those instances where there is convincing nutritional evidence that the added nutrients will provide substantial benefits to significant segments of the population.

The addition to foods of specific nutrients already adequately supplied by unfortified common foods is not only wasteful but tends to confuse consumers as to their nutritional needs and the nutritional properties of our food supply.

The need for a basic Food and Drug Administration policy with respect to fortification of foods arose in connection with hearings in 1940 on standards for flour and related products. Many proposals to enrich flour with most of the known vitamins and many minerals were made by various proponents of the flour industry.

The FDA took the position that the addition of a vitamin to flour would not be desirable unless there was evidence that a substantial part of the population consumed a diet deficient in the vitamin in question. Such evidence might be deduced from dietary surveys or from clinical observations with respect to the occurrence of deficiency diseases.

It believed that it was also essential to know whether a food is a suitable vehicle for retention of the vitamin through any processes that may be necessary in preparing the food for consumption. It was important to know too that the fortified product would reach the population that was receiving a diet deficient in a particular vitamin.

If these conditions were met, it was important to add the vitamin in suitable quantities. If flour provided 25 percent of the calories ingested, it seemed proper to require that the quantity of flour consumed daily should contain at least one-fourth of the daily requirement of the vitamin used for fortification. There seemed to be no purpose in adding more than the daily requirement to this quantity.

The principles stated at the 1940 hearings have been generally accepted as the basis for fortifying flour. They have been used as a guide in subsequent proposals to fortify other foods, and they have received support from the Food and Nutrition Board of the National Research Council.

In accordance with a basic policy, legal

standards for the following staple foods, containing added nutritive ingredients, have been established:

Enriched flour.

Enriched bread and rolls.

Enriched macaroni products.

Evaporated milk with increased vitamin D content.

Oleomargarine with added vitamin A.

Enriched corn products.

Standards for the same kind of foods without fortification have also been established. It will be noted that the Federal law does not require enrichment of these foods but leaves to manufacturers and consumers the freedom of choice to select the type desired. A schedule of sampling these standardized foods for vitamin, mineral, and other types of examination to determine compliance is a part of FDA regulatory operations.

### Some Regulatory Programs

The degree of attention given to specific types of products will vary from year to year, based on experience and need for broader or more restricted coverage. Regulatory programs have also been developed to provide for the selective sampling for laboratory examination of the numerous vitamin and mineral supplements and other foods for special dietary uses. Since the facilities for laboratory examination of products bearing vitamin and other nutritional claims are limited, other regulatory programs have been developed to protect consumers from exploitation through false and misleading nutritional and therapeutic claims for such articles. These projects are designed to deal with representations which are unwarranted regardless of the nutritional properties of the particular products involved.

Misrepresentations concerning foods, and particularly vitamin and mineral preparations, are a difficult problem for the Food and Drug Administration. Much misinformation has been furnished the public about nutrition and its relation to health. Some of this stems from competition and attempts to gain a sales advantage through advertising and other promotional material based on recent scientific discoveries of undetermined or unestablished

significance. The substantial contribution to consumer misinformation and deception made by nutritional quacks and faddists cannot be overlooked.

An intensified program of consumer education by all those in a position to furnish scientifically sound information about nutrition is necessary to increase the effectiveness of the various Federal and State laws designed for consumer protection in this area.

The broad statement that the food of the American people does not furnish a satisfactory diet is frequently made. The contention is that our soils have been so depleted that they can no longer produce plants of adequate nutritive value or that chemical fertilization of crops has resulted in reduced nutritive value.

These pseudo-scientific statements have an aura of plausibility but little scientific justification.

To only a very small extent is the composition of the parts of plants that people eat governed by the composition of the soil. The composition of the plant and its nutritive properties is controlled primarily by genetic factors which also control its size and shape. Much is made of the destruction of vitamins in cooking and loss of vitamins and minerals when the water in which foods are cooked is thrown away. To be sure, there are losses of this kind, but the facts have been greatly overemphasized. Such losses have been greatly reduced by improved methods of cooking. One must remember that man began cooking his food a long time ago.

Nutritional deficiency diseases in the adult generally result from restricting the diet to a single food or to a very few foods rather than cooking losses. In the Orient, beriberi occurs among populations confined principally to a diet of polished rice. Pellagra and riboflavin deficiencies were observed in the southern part of this country, largely among people whose diets were restricted by their economic status to cornmeal, fatback, and molasses. Their diets have been improved both by changed economic conditions and by a food enrichment program with the result that vitamin deficiency diseases are now rarely seen in this country.

The similarity between the symptoms observed in human beings and other animals suffering from nutritional deficiencies and those

resulting from non-nutritional causes has provided another fertile ground for exploitation of the consumer.

The extremely low incidence of demonstrable nutritional deficiency in this country has made it necessary for those with products to sell to talk in terms of "subclinical deficiencies" which, in less elegant language, means that the condition so described cannot be demonstrated to be of nutritional origin. This device, coupled with statements about the unreliability of our common food supply as a source of nutrients, because of soil erosion, cooking losses, and other similar misrepresentations, is typical of the misuses in which modern nutritional knowledge is being employed.

### Foods for Special Dietary Uses

The Food, Drug, and Cosmetic Act recognizes the difficult and technical problems in the labeling of vitamin preparations and foods used in the management of disease. Section 403 (j) of the act gives the Secretary of the Department of Health, Education, and Welfare power to promulgate regulations to cover the labeling of those products. It also requires that the labels of vitamin preparations show the vitamin content. Section 403 (j) reads:

"A food shall be deemed to be misbranded if it purports to be or is represented for special dietary uses unless its label bears such information concerning its vitamin, mineral, and other dietary properties as the Secretary determines to be, and by regulation prescribes as, necessary in order fully to inform purchasers as to its value for such uses."

Biochemists generally regard vitamins as foods since they are essential nutrients, needed for growth and maintenance of the body. Only minute quantities are needed daily. Since pharmaceutical manufacturers have equipment and personnel trained to handle such small quantities, vitamin preparations ordinarily fall into drug channels for distribution and marketing.

Vitamins are usually measured in units, milligrams, or even micrograms—terms unfamiliar to many laymen. To meet the requirements that labeling for foods for special dietary use must fully inform the purchaser, "minimum daily requirements" have been established for vita-

mins. The vitamin content of a preparation must be stated on the label in terms of the proportion of the minimum daily requirement provided in the recommended daily intake. The quantities of the four minerals, iron, calcium, phosphorus, and iodine, which before 1940 were the most frequently used supplements to the daily diet, must also be declared in the same manner.

Infant foods must be labeled to show all ingredients. Since the feeding of infants often presents problems, it is important that infant foods bear all the information necessary for their use. Labels of other foods are not required to name the spices, flavorings, or coloring material present. The label of a product that is a complete or partial substitute for human milk must state that additional quantities of vitamins C and D and of iron must be supplied from other sources if the quantities present are not adequate. The label must bear a quantitative declaration of vitamins A, B<sub>1</sub>, C, and D, and must list the percentages by weight of water, protein, fat, available carbohydrates, crude fiber, calcium, phosphate, and iron.

Many foods are offered for control of body weight, particularly by reducing. The label of a food for the control of body weight or the dietary management of disease must state the percentages by weight of protein, fat, and of available carbohydrates as well as the number of available calories in a specified quantity.

If crude fiber is represented to be of significance in a food, the percentage by weight must be declared on the label. If saccharine or a saccharine salt is used in a food in lieu of sugar, the label must bear the statement, "Contains -- saccharine (or saccharine salt, as the case may be), a non-nutritive artificial sweetener which should be used only by persons who must limit their intake of ordinary sweets." The weight of saccharine or saccharine salt is inserted in the blank.

If a food is for special dietary use because of reduced allergenic properties, the label must bear the common or usual name of each ingredient, including any spice, flavoring, or coloring used. The label must also contain a statement indicating the nature and effect of any process to change the allergenic properties of the food or its ingredients.

All of these requirements are contained in the food and drug regulations promulgated in 1941. The regulations have served their purpose well, but now they are somewhat outdated and in need of revision and extension.

A few years ago the labeling of foods with reduced sodium content became an important problem. It was shown that a reduced sodium intake was more important in the control of blood pressure than had been realized. Many foods on the market labeled "No salt added" contained considerable quantities of sodium from other sources although it was a statement of fact that no salt had been added. Some contained considerable amounts of sodium as a natural constituent. Sodium glutamate, which is used extensively for flavoring, and sodium propionate, which is an effective mold inhibitor, may contribute unsuitable quantities of sodium.

Foods labeled "No salt added" are attractive to a person seeking low sodium foods, but they have little value for the purpose desired. Such representations are, of course, misleading. There are a number of ways in which foods may pick up sodium in the process of manufacture, and producers of foods that are offered for the benefit of persons on a low sodium diet should determine the actual sodium content of the food.

The regulations require that if a food is represented to be of value because of a low sodium or low salt content, it must be labeled to show its sodium content in milligrams per hundred grams of food as well as per serving.

### The Division of Nutrition

The Division of Nutrition of the Food and Drug Administration is responsible for the development of scientific facts and opinions concerning nutrition as a basis for the policies and regulatory activities of the FDA. It also examines official samples for vitamin or other nutritional properties, by means of biological, microbiological, or chemical procedures which cannot be performed in the field laboratories of the FDA.

Under normal circumstances, the division's work is about equally divided between strictly enforcement operations and specialized research designed to facilitate or improve FDA enforcement of the Federal Food, Drug,

and Cosmetic Act. Research activities of the division have been limited almost entirely to the development or improvement of assay procedures for enforcement purposes. There is little incentive to do this kind of research in other nutrition laboratories. Such research has made possible a more rapid and precise examination of a greater number of samples without an increase in manpower.

The manufacturers of vitamin preparations have a very similar problem, and there has been excellent cooperation with industry laboratories in the study and development of control methods.

It is necessary that the Division of Nutrition keep abreast of the scientific developments in the field of nutrition. This is accomplished by a study of the scientific literature, communications and consultation with outside authorities in the field, and by attendance and participation in the activities of scientific societies and associations. It must also be alert for developments in manufacturing and labeling practices which may require changes in policies and regulatory activities in order to recommend such changes to the Commissioner of Food and Drugs.

In the case of litigation involving products examined in its laboratory, the division must be prepared to provide convincing scientific evidence of the deficiency suitable for presentation in the Federal courts. The division's analysts who are called upon to provide such testimony must be so qualified by training and experience that their evidence can successfully withstand cross examination.

In cases involving false and misleading claims about the nutritive or therapeutic value of vitamins, minerals, and other food factors, various members of the Division of Nutrition are called upon to testify as experts and must therefore be prepared to qualify as such in court. Among other things, they must have a comprehensive knowledge of the views of other experts in the field so that they may testify as to what constitutes the consensus of scientific authorities in the field of inquiry. Such qualifications are likewise of utmost importance to the work of the Food and Drug Administration, to the end that its actions and policies will be in accord with the best scientific knowledge available and enjoy the support of the outstanding authorities in the field of nutrition.

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## Fourth Annual Symposium on Antibiotics

The Fourth Annual Symposium on Antibiotics, sponsored by the Division of Antibiotics of the Food and Drug Administration, Department of Health, Education, and Welfare, with the journals, *Antibiotics and Chemotherapy* and *Antibiotic Medicine & Clinical Chemotherapy* will be held on October 17-19, 1956, at the Willard Hotel, 14th Street and Pennsylvania Avenue, NW., Washington, D. C.

To allow the program committee time to review material for presentation and to facilitate publication of the Antibiotics Annual 1956-57, manuscripts must be submitted by September 17, 1956.

For further information, address Dr. Henry Welch, director, Division of Antibiotics, Food and Drug Administration, Washington 25, D. C.

# New Problems of Food Safety

By FRANK A. VORHES, Jr., B.S., and ARNOLD J. LEHMAN, M.D., Ph.D.



The safety of food has been of concern to man from the very earliest times. Whether through instinct or intelligence, by trial and probably sometimes fatal error, forgotten benefactors of the race must have learned to eat substances that would not harm them; and they must have conveyed that knowledge to others, else we might not be here to speculate in this vein. Though probably accumulating slowly, a wealth of information regarding food safety had developed by the dawn of recorded history; witness, dietary customs and taboos reflected in the most ancient of ecclesiastic law.

With a few exceptions, those substances, natural or unnatural, that result in immediate acute harm are not the cause of food safety problems in modern civilization. Rather, it is the insidious hazard of chronic toxicity that is the most serious concern today, a hazard that demands a far more subtle and searching approach.

Current food safety problems arise in large part as a result of technological progress in food production, processing, and distribution. To meet economic pressures, the agriculturalist, that traditional conservative, must now intensively apply many types of advanced technology. His partner in "agribusiness," the food processor, is, of course, no novice in this field. Their joint accomplishment during the past sev-

eral decades is abundantly apparent in the ample quantity, high quality, and appetizing variety of foodstuffs available to the American public. Nonetheless, in the very nature of the progress that has brought these benefits, hazard to food safety is inherent. That fact does not necessarily mean that harm is actual or even imminent; but it does mean that need for gauging the existence and immediacy of danger is genuine and pressing.

One important group of current food safety problems stems from employment, in food production, of a long and lengthening series of chemical adjuvants—insecticides and insect repellants, fungicides, herbicides, defoliants, plant growth regulants, animal growth stimulants and medicaments, crop protectants and fumigants. These substances are commonly of complex, sometimes uncertain, and even occasionally unknown chemical identity. One of the problems in this area is to ascertain whether food exposed to them is contaminated and to gauge the degree of contamination.

In processing, food may receive preservatives, antioxidants, colors, bleaches, flavors, coatings, drying agents, moistening agents, thickening agents, sequestering agents, "aging" agents, stabilizers, emulsifiers, neutralizers, acidifiers, sweeteners—in short, retainers, modifiers, and inhibitors of virtually every property natural food may exhibit. (But we don't mean to imply any opposition whatever to genuine improvement per se.)

Associated with food production and processing are new equipment cleaners, sanitizers, and lubricants, new surfacing materials, and new alloys composing the equipment itself, any of which may get into the product.

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*Mr. Vorhes is chief of the Division of Food, and Dr. Lehman is chief of the Division of Pharmacology, Food and Drug Administration.*

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Today's food packages, incorporating new plastics, enamels, films, and tissues, with their own plasticizers, antioxidants, catalysts, impregnants, coatings, and the like, are still another potential source of additives to the very food which these materials are intended to protect from contamination.

Some anonymous philosopher has said that he who can get a corner on a food production adjuvant, used in even relatively minute quantity in this multibillion-dollar commerce, has his fortune made. Indeed, the benefit to their sponsors seems likely to prove the only net advantage of some proposed food additives. But we need not consider those wholly undeserving suppliants for entry into our food supply. Nor need we concern ourselves with most of those natural substances that have been tested through long years of use. Entirely aside from these, the novel and substantially artificial food additives that may be conceded some real functional merit are so many that an informed observer has no doubt whatever that they present food safety uncertainties. It is estimated that some 25,000 chemical additives have been considered for use in food since 1940 (see chart).

### **Safeguarding the Physically Subnormal**

Set aside for the moment (but don't forget) the fact that there is a large and growing backlog of study to ascertain food contamination from its production and processing adjuvants and to evaluate the toxicity of the adjuvants to normal adults in good health. Aside from that aspect, it remains generally to be determined what their effect may be on persons in subnormal physical condition.

No person is expendable within the meaning of the Federal Food, Drug, and Cosmetic Act. In a very significant decision (233 U. S. 399), the Supreme Court said that the food at issue "may be consumed . . . by the strong and the weak, the old and the young, the well and the sick; and it is intended that if . . . because of any added poisonous or other deleterious ingredient, [it] may possibly injure the health of any of these, it shall come within the ban of the statute."

Orthodox techniques and procedures of toxicology are not well suited to establishing that

a substance is safe for persons with varied types of physical impairments. Pharmacological investigation ordinarily proceeds on the basis of observable effects produced by administering the test substance to cloistered, well-fed and well-cared for, normal laboratory animals. However appropriately the findings so obtained may be interpreted in application to the human norm, there may be valid reservations to translating them into terms of effect on health of unusually susceptible individuals. The Supreme Court decision cited allows those responsible for safeguarding the food supply scant liberty to indulge in the educated guess or the calculated risk.

This consideration comes to a particularly critical focus with respect to milk, which may represent the principal component of the diet of babies, old folks, and invalids. The law authorizes establishment of tolerances for residues of useful pesticides "to the extent necessary to protect the public health." One may not assume that pesticides don't get into milk merely because no one purposefully puts them there. Pesticides are useful in production of feed and fodder crops, on dairy premises, and on lactating animals themselves. Some of them, particularly some halogenated hydrocarbons, when ingested or absorbed through the skin of animals, are known to appear in the milk—sometimes unchanged, sometimes modified by reaction within the animal system. One must consider whether residues of other pesticides so employed may perhaps have escaped detection in milk because the parent compound metabolizes to another toxicant unresponsive to methods of analysis so far employed. Under these circumstances there may be only an obscure basis, generally, on which to set tolerances for residues of pesticides used in connection with milk production.

The possibility exists, of course, that use of a pesticide would not contribute contamination to milk, but this raises other quite practical questions. For example, how does one ascertain that no residue whatever is present in a food? By analysis? That tool of science is designed to determine the presence of a substance, not its absence. It is capable of demonstrating some minimum concentration of a specific entity, such minimum being fixed by the limit of



# SIZE OF PRESENT PROBLEM

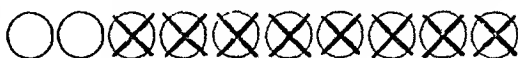
## CHEMICAL FOOD ADDITIVES

SINCE 1940-25,000 NEW SUBSTANCES GIVEN CONSIDERATION

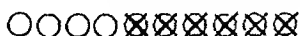
**20,000** ELIMINATED-  
ACUTELY TOXIC



**4,000** ELIMINATED-SUB-ACUTE  
& CHRONIC TOXICITY



**600** ELIMINATED-  
COMPLETE TOXIC TEST



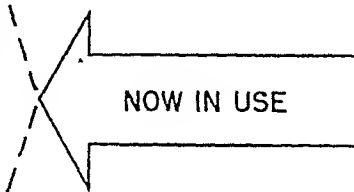
**150** IN USE WITHOUT  
ADEQUATE TESTING



**100** SAFE WITHIN  
LIMITS OF USE



**75** HARMLESS &  
NOW IN USE



delicacy of the analytical procedure. It cannot show, at least not directly, whether a lesser concentration exists or whether some substance unresponsive to the method is present. Before an adequate method of analysis can be selected or devised, a decision must be reached as to what concentration is of minimum significance, a decision that is practically equivalent to establishing the threshold of contamination. So one may be right back at the starting point. A gauge of harmfulness of the pesticide to the more susceptible segments of the population is ordinarily basic to justification of use of any pesticide, whether it is directly or indirectly associated with dairy practice.

### The Biochemical Approach

We cannot offer solutions to these problems, but we can suggest that an improved understanding of reactions that food additives may undergo in the animal (and human) system would contribute substantially. Were it possible to predict the character and extent of biochemical reactions that may cause harm, together with the reactions fostering protection

and recovery, not only would toxicological observations be most usefully supplemented, but uncertainties of analytical procedure might also be clarified. The first step would be to ascertain the route and fate of the ingested food additive. This may seem elementary, but such approach has too often been ignored or has been given but scant consideration. Application of the biochemical approach in the study of pesticides that inhibit cholinesterase activity furnishes a relatively recent and encouraging example of its value. At feeding levels much below those resulting in minimal tissue abnormality, these substances have been shown to lower, drastically, the activity of the important body enzyme, cholinesterase. Techniques by which this more delicate index of their harm was established have been adapted to methods of measuring the concentrations of their residues.

Some verbally resourceful investigator, seeking to explain the unexplainable, invented the term "subclinical symptoms." We are indebted to him for expression of a concept pertinent to food safety problems. The specter of as yet unmanifested harm from food additives may

not safely be laid to rest in routine fashion; and it may become a quite personal threat. Most of us have children; some have dependent invalids; many have grandparents; and all may hope to join the ranks of elder citizens. For any of these the ghost of subclinical symptoms may materialize, with tragic consequence, unless understanding of effects of food additives can keep pace with their increasing usage.

Another of the food additive problems, one that is virtually untouched by investigation, concerns the number and variety of the substances in use. In the aggregate they represent almost infinite possibilities for combinations of novel substances in the human diet. It seems hardly conceivable that there would not be some in which the effect of combined toxicants would be not only additive but synergistic.

Obviously, progress in exploring this problem by hit or miss testing of each possible combination, in a sufficient range of relative proportion, could be far beyond any foreseeable resources. However, improved understanding of biochemical reactions might go far in expediting useful findings. At least some examples of the phenomenon of synergism may reflect only associated biochemical reactions in which one agent reacts to produce the primary harm, while another impedes normal resistance or recovery mechanism. If this be even a rough explanation of synergism, quite unanticipated consequences could arise from combinations of toxicants, each present at a level which by itself would warrant no concern.

### **Cold Sterilization**

It would hardly be possible, these days, to discuss food-safety problems without bringing to mind those that could conceivably stem from what many informed food technologists believe to be a promising application of atomic energy, that is, so-called cold sterilization. This is accomplished by exposure of food to ionizing rays, either gamma rays, which are not basically different from the more familiar X-rays, or beta rays, which are simply fast-moving electrons. Nothing of significant substance is added to the food so processed; energy alone is imparted to it. Energy in this form produces in organic matter the effect of ionization. Ionization is a

molecular change that increases chemical reactivity. Consequently, chemical reactions occur in food as a secondary result of its irradiation. One product of such reactions is peroxide, not only the simple and familiar hydrogen peroxide but peroxides of other kinds, perhaps including those of most complex molecular structure. There is yet no assurance, and it is theoretically improbable, that reactions occurring are solely those producing peroxides. On the contrary, at this stage it appears more likely that the induced reactions are substantially heterogeneous rather than specific.

We disclaim any special knowledge in this area. Although the Food and Drug Administration has not hesitated to cooperate in an advisory capacity on questions within its competence, its responsibilities do not ordinarily extend to active participation in development of new processes. But new processes for food invariably pose potential food safety problems, and, accordingly, the agency always has been an interested observer of such developments.

We were reasonably well assured quite early, from information we received, that there was very remote possibility, if any, of inducing radioactivity in food by exposing it to such levels of radiant energy as are at all likely to become available, or even practicable, for such use. There has been no serious proposal whatever for the direct addition of radioisotopes to food. Radioisotopes, if used in cold sterilization, would be used solely as sources of radiant energy. Actually, at least some investigators of cold sterilization appear to favor mechanical generation of the energy, as more practical than deriving it from radioisotopes. There is room for appropriate concern, of course, that disposal of atomic wastes could result in contamination of water supplies and thereby introduce a threat to safety of the diet. Precautions so far taken, and realistically to be expected, appear to foreclose any immediate prospect of food hazard from such source. However, it will take constant vigilance to maintain that satisfactory situation.

Development of cold sterilization thus far has shown no essentially new or mysterious type of food safety problem. The energy, the application of it, and the mechanism of its



FDA inspector collecting import sample of meal at pier.

effect are new; but the end result seems to be of a quite familiar nature—the appearance in food of new and largely unknown chemical substances. Although probably much more complex, the problem seems basically of the same kind as those stemming from use of new chemical adjuvants in food production.

Radiant energy holds promise of production practicability for such objectives as preventing the sprouting of potatoes, killing trichina organisms in pork and insects infesting grain, pasteurizing a variety of foods sufficiently to extend their life very substantially without refrigeration, and retaining prominent elements of freshness in meat and other commodities.

Energy requirements for accomplishing these purposes vary. Sprouting of potatoes, for example, is inhibited at relatively low energy input; sterilization of micro-organisms generally requires almost 10 times as much. As energy

requirements increase, so do unfavorable side effects. The process is not promising for milk, for example, because of disagreeable flavor changes produced by energy input far lower than enough to pasteurize. Nutrient values are also affected at energy input sufficient to sterilize. Vitamins A, thiamine, riboflavin, pyridoxine, B<sub>12</sub>, ascorbic acid, and niacin are destroyed in varying degree, and some alteration in nutritive value of protein has been observed.

The observed organoleptic and nutrient changes in products subjected to cold sterilization confirm that expected chemical reactions do take place. They signify the possibility, if not the probability, of a wide variety of reactions and, hence, a wide variety of end products. Common prudence dictates a concern as to the identity of such end products. These are food additives, for all practical purposes. Good practice in toxicological investigation involves

feeding of experimental animals at a high level of a proposed food additive, with the objective of discovering the nature of definable injury, a middle level which may or may not give evidence of injury, and a lower level which does not affect the animal. The data so obtained permit an estimate of the margin of safety of the additive in use. Sole reliance on findings of orthodox toxicological study of irradiated foods themselves, in ignorance of both the identity and quantity of substances therein that may influence such findings, invites valid reservations to any final conclusions.

It can hardly be overemphasized that the problem of appraising the safety of cold sterilization is complex, of wide scope, and demanding of very considerable investigative resources. A great deal of work has been done on it, and significant progress has been made. It does not appear, however, that the safety of the process is anything like as near being established as is its production practicability.

### **Antibiotics as Adjuncts**

One class of potential food production adjuncts that does not currently constitute a problem in the same sense as the others discussed is the antibiotics. We have a sufficient gauge of their deleterious properties to conclude that, in food as consumed, their presence in virtually any concentration whatever is unjustified.

The wide and valuable usage of antibiotics in medicine is well known. The reasons for their curative efficacy are precisely the reasons that make them effective preservatives: They combat development of bacteria, the prime cause of food spoilage. It is not so generally appreciated that their medical usage is attended by distinct hazard of sensitization, varying in degree with different antibiotics. To the individual who is or has become sensitized, administration of an antibiotic may cause serious illness or even death. A method of developing sensitization is by administering the agent in small repeated dosage, in a manner paralleling that of repeatedly ingesting food preserved with an antibiotic. The use of antibiotics as food production adjuncts in ways

such that they actually are consumed is therefore manifestly contrary to the public interest, and the Food and Drug Administration has formally so declared.

However, there are a few justifiable uses of antibiotics in food production or processing. For example, it has been shown that fresh dressed chicken cooled in ice water containing 10 p.p.m. chlortetracycline will not absorb more than 7 p.p.m. of the antibiotic in any portion of the flesh, and that more than 99 percent of this pickup will be destroyed by any type of cooking sufficient to make the chicken suitable for consumption. The cooked treated chicken exhibits antibiotic activity no greater than that of untreated chicken. On this evidence, a tolerance of 7 p.p.m. of chlortetracycline, not to be exceeded in any part of the flesh, has been established for raw chicken.

Conceivably, there may be other, equally safe, food uses of antibiotics, but they would need to be equally well supported by fact in each case. It seems improbable, at this time, that many such instances could arise.

### **Summary**

Chemical additives, whether they be intentionally put into food or the incidental result of food production or processing procedures, are today the major cause for concern with respect to the safety of food. And it is the uncertainty surrounding these substances and their effects rather than any knowledge of actual harm that is the main reason for concern. In particular: What are the effects on persons with physical impairments? What are the effects of the multitude of combinations of the many substances in use?

In discussing any problem without at the same time describing measures taken toward its solution, or ancillary controls in effect pending final solution, it is difficult to avoid exaggerating the immediacy of evils the problem may involve. We have no wish to be alarmists. Our purpose has been to examine objectively some of the elements of needed knowledge that would contribute to understanding food safety problems.

# Control of Pesticides on Food

By WINTON B. RANKIN, M.S.



Pesticides are today considered essential for the production of an adequate, high quality food supply. But pesticides are poisons, and some of them, if not used properly, may leave harmful residues in or on food. In fulfilling its responsibility to protect the public from the addition to food of poisonous or deleterious substances, the Food and Drug Administration is therefore concerned with pesticides. Its objective is to limit pesticide residues to amounts that will be completely safe for consumption. It is concerned primarily with the possibility of chronic poisoning, rather than of acute poisoning, since the quantities of residues are ordinarily minute.

In accomplishing this objective, the Food and Drug Administration establishes tolerances for pesticide residues; that is, it sets the amount that may remain legally on crops shipped in interstate commerce. Establishment of a tolerance means that the pesticide can be employed usefully in agriculture, that residues within the tolerance are safe, that when the pesticide is used properly it will leave residues that are within the prescribed limit, and that crops shipped in interstate commerce shall not bear residues exceeding the prescribed limit. FDA may exempt a pesticide from the requirement of a tolerance if it finds that the pesticide will not leave poisonous residues.

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*Mr. Rankin is assistant to the Commissioner of Food and Drugs in charge of the pesticide chemicals program. He has been with the Food and Drug Administration since 1939.*

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The first regulations listing formal tolerances for pesticides were issued in March 1955. These tolerances were set under a public hearing procedure that required the Department of Health, Education, and Welfare to determine not only what level of residue is safe, but also that the pesticide is necessary in the production or handling of crops. This procedure was not particularly satisfactory to anyone. It was cumbersome and it required a health agency to make agricultural decisions.

Today, tolerances are established under a Federal law enacted in 1954, the pesticide chemicals amendment to the Federal Food, Drug, and Cosmetic Act, also known as the Miller amendment. This law provides new, more convenient procedures for determining how much poisonous agricultural spray or dust may remain safely on crops. It recognizes that sprays and dusts are necessary to insure a continuing supply of high quality foods, and it is designed to permit the effective use of these materials without hazard to the consumer. It assigns agricultural functions to the Department of Agriculture and health functions to the Department of Health, Education, and Welfare. It does not, however, make any change in the basic requirement that foods in interstate commerce shall be free of dangerous quantities of pesticide residues, which is a part of the Federal Food, Drug, and Cosmetic Act.

The new law provides that, within its jurisdiction, a raw agricultural commodity shall not be marketed if it bears a residue of a pesticide chemical, except under one of the following conditions:

1. The pesticide chemical is generally recognized by experts as safe.

2. The Government has established a safe tolerance for the residues of the pesticide chemical, and the residues remaining on the food are within this tolerance.

3. The Government has exempted the pesticide chemical from the requirement of a tolerance.

(For practical purposes a raw agricultural commodity is a crop as it is harvested, and a pesticide chemical is a substance that will destroy or control pests such as insects and weeds. More exact definitions are given in the law itself.).

### How the Law Works

There are three principal steps leading to the establishment of a tolerance under the new law:

1. A manufacturer of a pesticide (or any other interested party) submits a petition to the Food and Drug Administration requesting the establishment of a tolerance, a copy of which he sends to the Department of Agriculture requesting certification that the pesticide is useful for the purpose for which a tolerance is sought. In the petition, he must supply information about how he proposes to use the pesticide, the quantity of residues that will remain on the foods, and the toxicity of the residues when they are consumed throughout the life of test animals, such as rats or dogs.

2. Department of Agriculture scientists determine whether the pesticide is useful in agriculture when employed as proposed by the petitioner. If they find that it is, the Department transmits to the Food and Drug Administration a certificate of usefulness and also its estimate of the residues that are likely to remain on the foods.

3. Food and Drug Administration scientists study the experimental data given in the petition and all other available information, including that from the Department of Agriculture. On the basis of this study, FDA establishes a tolerance that meets both the requirements of safety and the needs of agriculture. The tolerance is set forth in a regulation published by the Commissioner of Food and Drugs. Residues within this amount may legally remain in or on the crops to which the tolerance applies.

The same procedure is followed in exempting a chemical from the requirement of a tolerance.

Thus far, formal tolerances or exemptions have been established for almost 100 pesticide chemicals. When the Miller amendment becomes fully effective on July 22, 1956, all pesticides will fall in one of four classes:

*Safe chemicals.* These may be used without a tolerance or an exemption, because they are not considered poisonous as used on crops. Sulfur, lime, and lime sulfur are in this group.

*Chemicals exempted from the requirement of a tolerance.* These are considered poisonous, but they are exempted for use on growing crops because excessive or harmful residues will not occur when they are so used. Many copper compounds and pyrethrins are among the materials in this group. (As yet, no pesticide has been exempted for postharvest use.)

*Chemicals with a zero tolerance or its equivalent.* Some of these, such as mercury- and selenium-containing compounds, are so toxic that no residue whatsoever should remain on food as it is marketed. Others in this group have not been studied enough to show whether they deserve a higher tolerance. Still others, such as tetraethylpyrophosphate, can be employed usefully in agriculture without leaving residues at harvest time. Any pesticide not specifically included in another group has the equivalent of a zero tolerance.

A zero tolerance does not mean that the chemical is barred from use in agriculture; it means that it must be used in such manner that no residue will remain when the crop is shipped.

*Chemicals with tolerances higher than zero.* Tolerances higher than zero have been set for numerous chemicals which are safe if the residues are kept within a certain limit but which are not safe for uncontrolled use. The tolerance for a chemical applies only to specific crops. The fact that a tolerance is in effect for one crop does not mean that residues of the same chemical may remain on another crop.

According to the Federal Insecticide, Fungicide, and Rodenticide Act of 1947, all "economic poisons" must be registered with the Department of Agriculture before they are shipped in interstate commerce. The directions for use on labels of pesticides thus registered should yield crops with residues within the tol-

erances set by FDA. Growers, therefore, have one simple rule to follow: They should use pesticides according to the label directions—on the crops specified, in the amounts specified, and at the times specified.

### Enforcement Procedures

The Food and Drug Administration enforces the Federal law with regard to pesticide residues on foods as follows:

Before the growing season, it studies new developments with regard to pesticides and new recommendations in spray schedules issued by the State agricultural authorities. During the growing season, FDA inspectors keep in touch with State authorities and growers to determine what sprays and dusts are used and how. The inspectors may pick up a few samples from farms, shipping points, or produce markets for laboratory examination to determine the accuracy of earlier tentative conclusions about the quantity of the residues remaining.

When the inspectors visit a growing area, they go openly. They cooperate with the State and local agricultural authorities, and they make every effort to be helpful. Unfortunately, the FDA laboratory facilities are extremely limited and cannot make tests for pesticide residues for all those who would like to have such tests made. However, if any of the samples collected from farms show high residues, the appropriate State authorities are immediately alerted so that steps may be taken to reduce the residues before the crop is shipped. Two examples of such preventive measures and their effectiveness may be cited.

In the fall of 1955, FDA learned that some growers in Texas were planning to use a chlorinated hydrocarbon pesticide on cabbage approximately 2 weeks before harvest. Past experience had indicated that application of this chemical that close to harvest would yield toxic residues. FDA notified its nearest field office, the United States Department of Agriculture, and the manufacturer of the pesticide chemical. The Department of Agriculture telephoned State agricultural officials, and they, in turn, warned the county agents. The manufacturer notified insecticide formulators in the area and asked them to help prevent misuse of the ma-

terial. An FDA inspector went immediately to the area and warned the growers at a meeting and by television and radio. As a result, the chemical was not used as planned, and the cabbage crop, when harvested, was safe for shipment.

In another case, some growers sprayed their lettuce with a pesticide the residues of which are not permitted on this crop. The rate of application recommended by the State was doubled, and harvesting was started too soon after spraying. FDA found that there were high residues of the chemical on the lettuce as harvested. It notified the State authorities immediately, and the State authorities directed the growers to trim the lettuce severely at harvest to remove the outer leaves containing the poison. One grower shipped two carloads of lettuce without trimming it, and they were seized by the FDA.

FDA would much rather prevent violations than seize crops. Seizure action is reserved for extreme cases. Ordinarily, preventive measures are adequate to insure the shipment of satisfactory produce.

In commenting on seizures, George P. Larrick, Commissioner of Food and Drugs, said: "Growers do not have excessive spray residues on their crops when they observe proper precautions in using agricultural sprays and dusts, but misuse of such chemicals can leave poisonous residues that make a crop illegal in interstate commerce."

State and local health departments will continue to receive reports of injury and illness attributed to pesticide residues in food. In many instances investigation will show that pesticides are not at fault.

However, there may be occasions when misuse of a pesticide will leave dangerous residues on food. In these instances the health department can be of great value to agriculturalists and to the Food and Drug Administration by determining, among other things, what pesticide was employed, when it was applied to the crop, what rate of application was used (generally in pounds of actual pesticide per acre of crop), what stickers, spreaders, or adjuvants were employed with the chemical, when the crop was harvested, and what methods were em-

ployed to reduce the residue, such as washing or brushing or discarding of outside leaves of such crops as cabbage and lettuce. This type of information will help those responsible for recommending spray schedules to determine whether present label directions on pesticides are in need of revision.

An example of the type of misuse that may cause difficulty occurred last year in southern California: To control aphids, a grower sprayed a field of mustard greens with nicotine sulfate solution a few hours before harvest. The nicotine sulfate was old and the grower assumed that it was weak. He prepared a spray twice as strong as recommended. Then, because the

aphid infestation was heavy, he applied it at four times the recommended rate per acre. The mustard greens were harvested less than 24 hours after spraying and marketed immediately. State and local health authorities embargoed outstanding lots of the greens when they began causing illness. Samples of the greens contained 70 to 90 parts per million of nicotine.

FDA appreciates reports of this type of misuse. They will help determine how well established tolerances are being met in actual practice. Reports may be sent to the nearest FDA district office or to headquarters in Washington, D. C.

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## Research in Cancer Chemotherapy

Under contract with the Public Health Service, five laboratories are engaged in large-scale screening of chemical compounds in the search for drugs useful in treating cancer. It is expected that they will test approximately 2,000 compounds by July 1, 1956.

The laboratories, which began work early this spring, are: Microbiological Associates, Bethesda, Md.; Wisconsin Alumni Research Foundation, Madison, Wis.; Southern Research Institute, Birmingham, Ala.; Hazleton Laboratories, Falls Church, Va.; and Stanford Research Institute, Menlo Park, Calif. The Cancer Chemotherapy National Service Center of the Public Health Service National Cancer Institute has the responsibility for supervising the contracts.

Each compound will be tested against three different kinds of mouse tumors implanted into various strains of mice bred for cancer susceptibility, under procedures for animal screening established by a panel of the Cancer Chemotherapy National Committee. This committee, representing the leading organizations and Government agencies in the field of cancer research, was established in May 1955 to sponsor a national voluntary program of cooperative research and development in cancer chemotherapy.

At present, surgery and radiation are the only means of achieving cancer cures, but some forms of cancer, such as acute leukemia, are not amenable to these treatments. Other forms may be diagnosed only after they have spread throughout the body, too late to be benefited by either surgery or radiation. In such cases, chemical treatment appears to offer the greatest hope. Compounds now in use have been successful in prolonging the useful life of patients suffering from cancer of the breast or prostate or cancer of the blood-forming tissues, but these compounds are not curative.



# Certification of Coal-Tar Colors

By G. ROBERT CLARK, Ph.D.



Use of toxic dyes in food was one of the public health problems which led to the passage of the original "pure food law" in 1906. Today, 50 years later, protection of the public from dyes that are harmful to health is still an important purpose of the Federal food and drug legislation.

The Federal Food, Drug, and Cosmetic Act of 1938 provides that coal-tar colors used to color any products subject to the act, except hair dyes, must be from batches certified for such use under regulations promulgated by the Secretary of Health, Education, and Welfare. It characterizes food, drugs, and cosmetics containing uncertified coal-tar colors as adulterated. The law applies both to products manufactured in this country and to imports.

The term "coal-tar color" as used for purposes of the law means any coloring matter that is or may theoretically be derived from coal tar. It has continued in the language since the days when coal tar was the only source of many organic chemicals that are now obtained from various sources, particularly petroleum. The word "color" is usually used instead of "dye" because, in the trade, the word "dye" refers only to soluble material; it does not include insoluble material such as that used to color face powder. However, the two words are frequently used without this distinction.

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Coal-tar colors are made from a number of chemical compounds called intermediates. If these intermediates have one thing in common, it is their high toxicity. Almost all dye intermediates are known to be poisonous.

Many of the thousands of known coal-tar colors are extremely toxic when taken internally. Some are irritants and sensitizers when applied to the skin. Some are carcinogenic. Actually, comparatively few colors have ever been tested to determine their safety for use in foods, drugs, and cosmetics. Colors need to be so evaluated, of course, only if such use is contemplated.

Dyes, like many other chemicals, are manufactured in reaction vessels from chemical compounds that, in turn, have been manufactured. In these processes, the dye may pick up such materials as lead, arsenic, mercury, cadmium, or chromium. For most uses, these do no harm, but in food, drugs, or cosmetics, they are likely to be a hazard to health.

From this brief description of coal-tar colors, it is obvious that food, drugs, and cosmetics should contain only thoroughly tested colors. The colors themselves must be nonhazardous, and they must be free from harmful quantities of contaminants. The provisions of the Federal Food, Drug, and Cosmetic Act that require certification of coal-tar colors were designed to make certain that only "harmless" dyes are used in products subject to that act.

The color certification program of the Food and Drug Administration is designed to carry out the provisions of the act pertaining to coal-tar colors. This program, which is one func-

tion of the Division of Cosmetics, is set up to do the following:

1. To list colors as certifiable when there is evidence to show that they are harmless and suitable for use, and that practical and accurate methods of analysis are available. New colors are added only on the basis of specific requests by manufacturers.

2. To conduct such analytical and investigative work as may be necessary to certify batches of coal-tar colors. Certificates are issued for individual batches on the basis of analyses of samples submitted by the manufacturer.

3. To conduct enforcement activities to insure compliance with the law.

Fees for certification based on the weight of the batches are paid by the manufacturer. These fees equip and maintain the certification service.

It is the aim of the Food and Drug Administration to achieve the following with respect to coal-tar colors:

1. Each color listed as certifiable must be completely characterized chemically. A sample of each batch manufactured must be completely analyzed chemically to make certain that it does not differ materially from the material submitted to pharmacological testing.

2. Each color listed as certifiable must have been thoroughly evaluated by pharmacological investigation. This investigation must show that the color is harmless and suitable for use.

Almost constant investigations are carried on in the attempt to realize this optimum state of affairs. When new techniques of analysis become available, they are applied to coal-tar colors.

### History of Color Certification

Official recognition of the possibility of hazard to health in the use of synthetic dyes in food was evident as early as 1900. The appropriation for the Bureau of Chemistry of the Department of Agriculture, May 25 of that year, included funds "to enable the Secretary of Agriculture to investigate the character of proposed food preservatives and coloring matters, to determine their relation to digestion and health and to establish the principle which should govern their use. . . ." Several Food

Inspection Decisions issued under this authority were in respect to foods offered for import into the United States. These decisions required notification of the addition of preservatives and colors to foods and freedom of such additives from deleterious properties.

Certification of colors used in food was begun in 1907, when the Federal Food and Drugs Act of 1906 became effective. Under this act, a list of colors permissible for use in food was adopted by the Board of Food and Drug Inspection, and certification of batches of these colors by the Department of Agriculture was optional with the manufacturer. Use of non-certified colors could not be a basis for regulatory action unless it could be shown that the food might be injurious to health by reason of harmful components of the colors used. It was not until 1939 that certification of batches of colors became mandatory and certification of colors used in drugs and cosmetics was begun.

The rules originally used in selecting colors for food, as stated in 1912 by Dr. Bernard C. Hesse in the Bureau of Chemistry Bulletin No. 147, were as follows:

Rule I: All colors which have not been physiologically tested either on man or animals shall not be permitted for use in foods.

Rule II: All colors which have been examined but with contradictory results shall not be permitted.

Rule III: All examined colors which are doubtful shall not be permitted.

Rule IV: Only those colors on the United States market in 1907 which are of definite composition and which have been examined with favorable results shall be permitted.

The adoption of colors today is based on the same principles. However, the tests applied are much more rigid and extensive than those used in 1907.

Under the original color regulations, certificates for individual batches of colors were issued by the Department of Agriculture on the basis of an affidavit of analysis by the manufacturer and a second affidavit of analysis by a competent scientist. These certificates were not based on analyses made by the Department; rather, they were approvals of the affidavits submitted by the manufacturer. Later actions set up a system of certification of batches based on

analyses made by the staff of the Department. This system made possible standardization of methods, and it is the basic system in use today.

From time to time, additional colors were added to the original list. Two colors, butter yellow (*p*-dimethylamino-azobenzene) and Sudan I (1 phenylazo-2-naphthol), were listed as certifiable and then withdrawn about 6 months later, on June 7, 1919. These colors were removed from the list because they produced a skin rash on persons handling them in quantity. The carcinogenic properties of butter yellow are now well known, but no hint of these properties was disclosed until several years after use of that color in food had been abandoned. In 1938, when the new law was passed, there were 15 colors listed as certifiable, all of which had been listed for at least 9 years.

#### Regulations Under the 1938 Act

When certification of colors for food, drugs, and cosmetics became compulsory, prompt adoption of lists of suitable colors was essential. After discussions with the dye manufacturers and representatives of the food, drug, and cosmetic industries, a number of colors were selected. They were tested chemically and submitted to such tests for toxicity as facilities permitted. Because it was necessary to adopt lists quickly in order to prevent a chaotic situation in the industries, the tests were considerably less than optimum. The chemical information was sometimes incomplete and sometimes, it was later learned, based on erroneous literature. The pharmacological information suffered from lack of data about the chronic toxicity of the dyes. The final step in the selection of colors was a series of hearings at which any interested party was permitted to testify and to cross-examine witnesses.

Following these hearings, regulations listing certifiable colors were adopted. These are substantially the regulations now in force. The colors are separated into three classes:

FD&C colors: Certifiable for use in coloring food, drugs, and cosmetics. These included all the colors that had been listed under the 1906 act.

D&C colors: Certifiable for use in coloring

drugs and cosmetics, but not in food. These colors were all new to certification.

Ext D&C colors: Certifiable for use in coloring externally applied drugs and cosmetics, but not for food or for drugs or cosmetics applied to a mucous membrane. These also were colors not previously certifiable.

No colors are certified for use in the area of the eye, since no drugs or cosmetics intended for use in this area may be colored with any coal-tar color.

Shortly after the first regulations under the 1938 act were adopted, three additional colors were added to the FD&C list. Two of these were oil-soluble dyes, FD&C Orange No. 2 and FD&C Red No. 32, used principally in the external coloring of oranges. The other was FD&C Yellow No. 2, the potassium salt of 2,4-dinitro-1-naphthol-7-sulfonic acid. (FD&C Yellow No. 1 is the corresponding sodium salt.) Oddly enough, no batch of FD&C Yellow No. 2 has ever been certified.

Later actions added one color to the list of Ext D&C dyes and placed one of the original D&C colors on the FD&C list as FD&C Violet No. 1.

The preparation and adoption of the coal-tar color regulations was a remarkable feat of cooperation between Government and industry. Both parties combined in the effort to make the regulations practical for the industry and effective for protection of the public. It is a tribute to their success that no basic changes in the regulations have been made except those dependent on information not available in 1938.

#### Recent Activities

It was realized in 1938 that the lack of data about chronic toxicity of coal-tar colors was a matter that required attention. Some studies were conducted, but the imminence of war and the war itself made it impossible properly to attack the problem until several years later.

Research in development of improved methods of chemical analysis was continued, but this work also was largely suspended during the war years. After the war, the availability of new apparatus, particularly spectrophotometric instruments, made progress much more rapid and results more certain.

## Certification of FD&C Yellow No. 6

Specifications and procedures for FD&C Yellow No. 6 illustrate the requirements that colors must meet and the tests they must undergo in order to be certified.

### *General Specifications for All FD&C Colors*

"No batch of a straight color listed . . . shall be certified under these regulations unless—

"(a) It is free from all impurities (other than those named in paragraph (b) or in the specifications set forth . . . for such color) to the extent that such impurities can be avoided by good manufacturing practice.

"(b) It conforms to the following specification:  
(1) In the case of a straight color listed in section 9.3 [i. e., an FD&C color]—

Lead (as Pb), not more than 0.001 percent.

Arsenic (as  $As_2O_3$ ), not more than 0.00014 percent.

Heavy metals (except Pb and As) (by precipitation as sulfides), not more than trace."

### *Specific Requirements for FD&C Yellow No. 6*

FD&C Yellow No. 6 is described as a "disodium salt of 1-*p*-sulfophenylazo-2-naphthol-6-sulfonic acid." It must meet the following requirements:

Volatile matter (at 135° C.), not more than 10.0 percent.

Water insoluble matter, not more than 0.5 percent.

Ether extracts, not more than 0.2 percent.

Chlorides and sulfates of sodium, not more than 5.0 percent.

Mixed oxides, not more than 1.0 percent.

Subsidiary dyes, not more than 5.0 percent.

Pure dye (as determined by titration with titanium trichloride), not less than 85.0 percent.

### *Analytical Determinations*

Determination of total dye in the sample by titration with titanium trichloride, which quantitatively reduces the azo group.

Determination of the identity and quantity of dye by spectrophotometric procedures. Spectra in the visible, infrared, and ultraviolet regions are obtained and compared with spectra obtained from standard samples prepared in the FDA laboratories.

Determination of sodium chloride, sodium sulfate, insoluble matter, and volatile matter.

Determination of subsidiary dyes. Sodium salts of the following may be present: 1-phenylazo-2-naphthol-6-sulfonic acid, present if the sulfanilic acid used as an intermediate contains any aniline; 1-*p*-sulfophenylazo-2-naphthol-3,6-disulfonic acid and 1-*p*-sulfophenylazo-2-naphthol-6,8-disulfonic acid, present to some extent in all samples since it is almost impossible to prepare 2-naphthol-6-sulfonic acid entirely free from the disulfonated compounds; 1-(4-sulfophenylazo)-2-naphthol, present because some betanaphthol may be present in the sulfonated compound.

Determination of ether extracts, a measure of any organic tars or other ether soluble substances that may remain in the intermediates.

Determination of uncombined intermediates, present because of incomplete diazotization or coupling. Sulfanilic acid and 2-naphthol-6-sulfonic acid are the intermediates used for FD&C Yellow No. 6.

Determination of mixed oxides (iron, aluminum, etc.) that may be present. These usually get into the product because the processing equipment is attacked by reagents used in preparation of the dye.

Determination of lead and arsenic, usually present in the acids used in the sulfonation and nitration reactions carried out in the preparation of the intermediates.

Determination of heavy metals—copper, bismuth, tin, antimony, cadmium, and mercury. These also get into the dyes from processing equipment.

In addition, to meet the "good manufacturing practice" requirement in the general specifications, it must not contain more than traces of uncombined intermediates or of phenylazo-2-naphthol-6-sulfonic acid. Experience of many years has shown that it is practical to obtain almost complete removal of these impurities.

### *Certification or Rejection*

If the sample is found to meet all the specifications, including the "good manufacturing practice" requirements, a certificate covering the batch is issued. If the sample fails to meet any one of the specifications, the batch is rejected.

Recent chemical investigations have shown that some of the colors do not have the exact composition or structure ascribed by earlier work. This information will probably not affect the status of the colors as certifiable, but it is of fundamental importance in establishing methods of analysis and standards that batches of the colors must meet in order to be certified.

Methods of analysis for coal-tar colors are a part of the program of the Association of Official Agricultural Chemists, and the results of the FDA's chemical investigations are usually published in the journal of that association. A mimeographed publication containing the methods of analysis used in the color-certification laboratory is also available.

Some of the recent pharmacological investigations have produced surprising results. Three colors, FD&C Orange No. 1, FD&C Red No. 32, and FD&C Orange No. 2, have been found to be considerably more toxic than was disclosed by earlier tests. These dyes act as gastrointestinal irritants. The toxicity of FD&C Orange No. 1 and of FD&C Red No. 32 has been confirmed by illness following ingestion of candy or popcorn containing these colors. In each case, the products contained very much more color than is customarily used.

As a result of the new tests, the Secretary of Health, Education, and Welfare issued a regulation removing the three colors from the lists of colors certifiable for use in food and drugs in November 1955. This regulation is now in effect with the exception of its application to FD&C Red No. 32 for coloring the outer skin of oranges. A stay issued by the Fifth Circuit Court of Appeals requires the continued certification of sufficient color for that use until the court has finally disposed of a petition to review the entire regulation. The colors were retained as certifiable for use in externally applied preparations since evidence is available to show that they are safe for such use.

Legal action against excessive use of certified colors is not authorized under the Federal Food, Drug, and Cosmetic Act. Section 406 (b) reads: "The Secretary shall promulgate regulations providing for the listing of coal-tar colors which are harmless and suitable for use in food, and for the certification of batches of such colors with or without harmless dilu-

ents." Sections 504 and 604 have almost identical wording with respect to colors for drugs and cosmetics.

The meaning of the word "harmless" is the cause of difficulty. The Food and Drug Administration believes the word to mean that the colors must be harmless per se, that is, without regard to the amounts of colors that would or could be consumed by the individual. This means, of course, that the colors must be without detectable physiological effect except that of inert or nonnutritive substances. The absolute harmlessness of any substance is virtually impossible to demonstrate.

The production of certified colors has increased steadily with the general expansion of the national economy. In 1941, about 2¼ million pounds of coal-tar colors were certified in 3,677 batches. In 1955, the amount was more than 5 million pounds in 4,675 batches. These figures include not only the highly concentrated "straight" colors, but also mixtures of the colors with various diluents, such as salt, sugar, or water. Such mixtures, which may contain two or more colors as well as diluents, are usually used instead of the straight colors in coloring food.

Certification of the 4,675 batches of coal-tar colors in 1955 required more than 25,000 analytical determinations, or about 100 per working day. An example of the certification requirements and procedures is given on page 584.

There have been very few regulatory actions against products containing uncertified colors in recent years. The requirements of the law are well known, and the food, drug, and cosmetic manufacturers generally make every effort to comply. In a few instances, products made in other countries have been denied entry into this country because they were found to contain uncertified colors.

Investigation of the production procedures used by the manufacturers of straight colors and mixtures has shown that few have failed to follow the regulations in every particular.

#### Program Needs

By law, the listing and certification of coal-tar colors is performed only upon payment of such fees as may be necessary to provide, main-

tain, and equip an adequate service for such purposes. Hence, the certification program is not handicapped by a lack of funds. But as demands for services increase, it is necessary to adjust facilities and personnel accordingly. Since the present program is the maximum that

can be contained in the available laboratory and office space, relocation of the facilities is a matter for immediate attention. Recruiting and holding an adequate supply of personnel is a chronic problem, but at the moment at least all assigned positions are filled.

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# Drugs and Medical Devices

By ALBERT H. HOLLAND, Jr., M.D.



The medical program of the Food and Drug Administration is concerned primarily with assuring the safety of drugs and medical devices to protect public health as provided by law. Secondly, it advises the Commissioner's Office and the other scientific and administrative programs of FDA on medical matters.

The major elements of the medical program may be characterized by the words "Stop, look, and listen." As provided by law and regulation, FDA attempts to stop the violator; it looks at new drug applications and medical investigative data; and it listens to what is going on generally in the drug and device industries so that proper preventive or remedial action can be instituted when necessary.

The objective of the Federal Food, Drug, and Cosmetic Act with respect to drugs is to assure the safety, quality, purity, and identity of all drug products in interstate commerce, thereby fulfilling the ultimate objective of protecting the public health. Drugs imported into this country are subject to the same scrutiny and legal requirements.

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*Dr. Holland is medical director of the Food and Drug Administration. When appointed to this position in 1954, he was medical director of the Armour Laboratories. He has also served as director of the Office of Research and Medicine, Oak Ridge Operations of the Atomic Energy Commission, and as medical officer assigned to the Manhattan Engineering District project at Oak Ridge.*

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Actually, all aspects of the medical program are geared to one key word—safety. Purity, quality, identity, and labeling, including therapeutic claims, must all measure up to the requirements imposed by the reasonable application of the concept of safety.

It is perhaps of significance that the original Federal food and drug legislation, the Food and Drugs Act of 1906, was conceived and enacted by the Congress at the behest of a physician, Dr. Harvey W. Wiley, who was at the time chief chemist of the Department of Agriculture. The Food and Drug Administration, therefore, has a medical heritage of which it can well be proud and which clearly establishes it, both historically and for the future, as a public health agency of government.

## Responsibilities and Functions

The New Drug Branch of the Division of Medicine bears the responsibility for reviewing new drug applications in detail, interpreting the investigative data, and permitting or denying the introduction of a new drug into interstate commerce. Its task is one that requires the exercise of the highest degree of good judgment and medical acumen. It is one thing to assess the investigative results obtained by a few medical experts in carefully selected patients under controlled conditions; it is quite another to extrapolate that data to nationwide use—perhaps indiscriminate use by some physicians or by the public if the drug is one that may legally be sold without a prescription.

The Veterinary Medical Branch has the same purview of new drugs for animal use as does

the New Drug Branch of drugs for human use. In addition, it has a regulatory or enforcement function for all veterinary medicinals, be they old or new drugs.

The Drug and Device Branch works primarily to obtain compliance with, and enforcement of, the law with respect to the safety and adequacy of labeling of drugs and medical devices in interstate commerce. But to apply scientific judgment in a court of law entails peculiar difficulties. Medicine at its best is still far from being an exact science. Biological variation and biological response in the subject, as well as variations of interpretation by the investigator, frequently preclude satisfactory quantitation. The art and the science are not always clearly distinguishable, and opinion and fact are not always readily separable. That this is true becomes evident when FDA resorts to legal measures to achieve enforcement and control. Honest admission of uncertainty by a scientific witness may too often strike a jury as "reasonable doubt" as to the guilt of the defendant. To reach a bona fide medical conclusion is one thing; to prove it beyond reasonable doubt in a court of law is quite another.

One important aspect of assuring the safety of drugs and devices is preventing misbranding. The legal definition of misbranding has many facets. Those readers who are responsible for enforcing parallel State laws know them well; for others, a few basic concepts that illustrate the philosophy of the law may be mentioned here.

A drug or device is deemed to be misbranded:

1. If its labeling is false or misleading in any particular.
2. If, in finished or bulk package form, it fails to bear a label giving the name and place of business of the manufacturer, packer, or distributor, and an accurate statement of contents.
3. If any word, statement, or other information required under the authority of the act to appear on the label or labeling is not displayed with such conspicuousness and in such terms as to make it likely to be read and understood by the ordinary individual under customary conditions of purchase and use.
4. Unless its labeling bears adequate direc-



FDA inspector in the stock-room of a drug factory producing injectables. The bulk solutions are examined for undissolved particles before they are packed and sealed in ampoules.

tions for use, adequate warnings against use in pathological conditions or by children when such use may be dangerous to health, and adequate warnings against unsafe dosage or methods or duration of administration or application. This does not, however, apply to household chemicals except those specifically covered in the Federal Caustic Poison Act. Under the Federal Food, Drug, and Cosmetic Act all drugs are subject to this requirement.

From the foregoing it is apparent that the food and drug legislation is designed to inform and protect the user of drugs or devices whether he be a physician or a patient. While the law is designed to protect, it is well also to recognize its limitations. The Federal Food, Drug, and Cosmetic Act applies only to the content and labeling of products shipped in interstate commerce. The Food and Drug Ad-



ministration, therefore, is not responsible for advertising, which is regulated by the Federal Trade Commission. FDA does, however, cooperate with the Federal Trade Commission, usually by making, at its request, laboratory studies of products in question. In addition, FDA provides the medical support for fraud cases brought by the Post Office Department.

### Techniques of Control

To carry out the provisions of the law, the Food and Drug Administration employs many techniques. It maintains a nationwide inspection staff of approximately 250 men who devote their time to food and drug inspections in all channels of distribution from manufacturer to the ultimate distributor. It also maintains a series of field laboratories where samples of drugs are analyzed.

FDA is in continuing contact with all segments of the drug trade and with the medical profession. It is now in the process of enlarging its file of reports on injuries from drugs and household chemicals. The Research and Reference Branch of the Division of Medicine is interested in all types of drug injuries or suspected injuries whether they culminate in death, blood dyscrasias, sensitivity reactions, or other toxic manifestations. Often it is only by slowly and painfully piecing together the puzzle that a significant pattern is found. FDA must and does maintain constant surveillance of the medical literature and medical reports, as well as its incoming mail. Recently, the medical staff has had occasion to work with those interested in the operation of poison control centers throughout the country.

Public health officials can be of great assistance to the Food and Drug Administration in providing the protection which the law intends and which so many people take for granted. For example, health officers often are in a position to supply information about the business of a cancer quack, about medical devices which may not meet the requirements of the law, or about injuries caused by drugs.

About a cancer quack, FDA needs to know such things as how he is operating his racket, the names of his patients, when his patients die, and findings of autopsies.

About medical devices, FDA needs to know: When and where are they sold and used and by whom? What claims are made for them? Is an interstate shipment involved? Is there label copy or descriptive literature available?

An immediate report of a drug injury or a suspected injury containing all the facts available is of utmost importance. What was the drug used? How was it administered? By whom? What dosage was employed? What is the name of the manufacturer? of the patient? of the physician? Too frequently FDA does not hear of adverse experiences with drugs until months after they occur, when the details crucial to intelligent interpretation have been forgotten or are no longer available.

To protect the public against adulterated or misbranded medicines, as provided by law, the Food and Drug Administration needs the assistance of all persons who are concerned with health, whether they be physicians in private practice, officials of government agencies, or members of the drug and device industries. It also needs the understanding and cooperation of an informed public.



# Assuring the Safety of New Drugs

By RALPH G. SMITH, M.D.



Before the Federal Food, Drug, and Cosmetic Act was passed in 1938, new drugs could be introduced into interstate commerce without approval from any Federal agency or without consultation with any Federal agency. The distributor had no responsibility under Federal law for the safety of the new product. The marketing of drugs was subject to the provisions of the Food and Drugs Act of 1906, which dealt with adulteration and misbranding of drugs only after a drug was in the channels of distribution. The 1906 act did not deal directly with safety of drugs.

Although many of the drugs on the market in 1938 were satisfactory, further control was needed. With the advancement of pharmaceutical chemistry and the expansion of pharmacological research and screening procedures, particularly by industry, many new products were becoming available for drug use.

Most of the new products were synthetic compounds, but a few were purified active agents of old galenical drugs or derivatives of these agents. Many had specific pharmacological actions and were, accordingly, of interest from the therapeutic standpoint. In addition to useful therapeutic actions, however, some of the new products possessed potentialities for harmful effects. As with all new compounds, the

nature of these effects and the margin of safety could be revealed only by appropriate study. Some control, additional to the judgment of the distributor, on the safety of the drug seemed to be in the public interest.

Accordingly, early drafts of the Federal Food, Drug, and Cosmetic Act included a provision that a drug was misbranded if it was unsafe for the use suggested in its labeling. By a coincidence, the well-known elixir of sulfanilamide disaster, which occurred while the bill was under consideration, convinced the Congress of the necessity for new drug provisions in the law. As a result of a new toxic vehicle or solvent in the sulfanilamide product, more than 100 deaths occurred within a very short time and before adequate warnings or removal of the drug from the market was possible.

## For Effective Application

The new drug section of the 1938 act prohibits the distribution in interstate commerce of a new drug until an application for it is effective. In order for the application to become effective, adequate evidence that the drug is safe when used according to the labeling furnished for it must be included in the application.

Applications for new drugs are received and reviewed by the New Drug Branch of the Division of Medicine, Food and Drug Administration. The review procedure calls for the assistance of other FDA technical divisions whenever indicated. The advice of original investigators or of other organizations or of experts outside the FDA may be sought in specific instances.

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*Dr. Smith is chief, New Drug Branch, Division of Medicine, Food and Drug Administration.*

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Since products which are not new drugs may still be introduced into interstate commerce without any legal formalities or even notification to the Food and Drug Administration, it is of obvious importance to decide whether a drug is new. In many instances the answer is apparent, but in certain cases some definite criterion is necessary for a decision.

A definition of a new drug is included in the 1938 act. In simple terms, a new drug is a drug which is not generally recognized, by experts qualified to evaluate the safety of drugs, as safe when used as directed in its labeling.

A yardstick is even more necessary to determine when a product ceases to have the status of a new drug. This point is also covered by definition in the act. Even though sufficient evidence may be available from investigative studies to show that a drug is safe for use, the drug continues to be considered as a new drug until it has been used to a material extent or for a material time under the conditions set forth in its labeling.

Continuance of a product in new drug status for a considerable period of time is significant in two ways. It means that the product must not only be indicated as safe by investigative studies but that it must stand the test of use under ordinary marketing conditions before it loses its new drug status and is freed from the restrictions which the status entails. It also means that any company wishing to market the drug must also obtain an effective new drug application even though the drug is already being distributed by the company holding the original effective application. Each additional application must include adequate evidence of the drug's safety.

The definition of a new drug is further interpreted by regulation. Food and drug regulations point out that a product may be considered new not only when it contains a new active ingredient but also when it includes a new excipient, coating, menstruum, carrier, or other component. A new combination of two or more old drugs or a change in the usual proportions of the ingredients in an old combination may cause the product to be considered a new drug. A new use, a new dosage schedule, or a new route of administration for a commonly recognized drug may also result in a

new drug within the meaning of the definition.

In many instances little difficulty arises in deciding that a drug is new, but there are also numerous cases in which a decision can be reached only by careful consideration of all available facts. It must be determined whether the changes from recognized formulations or therapeutic procedures are sufficiently significant to raise a question of safety. An honest difference of opinion on the new drug status of a product occasionally arises between the manufacturer and the Food and Drug Administration. The difference may be resolved in either direction on consultation. Generally, however, the advice of the Food and Drug Administration is accepted although the Federal courts have the jurisdiction for deciding the matter.

Although the new drug section of the 1938 act is applicable to most new drugs, there are certain exemptions. Drugs which were distributed under essentially the same labeling prior to the effective date of the act (June 25, 1938) are excluded by definition even though they may not be generally recognized as safe. Vaccines, serums, toxins, antitoxins, and most blood products which are licensed under the Biologics Control Law enforced by the Public Health Service are exempt by regulation from the new drug procedure. Likewise, the five antibiotics, penicillin, streptomycin, aureomycin, chloramphenicol, and bacitracin, and derivatives of those antibiotics that are subject to certification by the Food and Drug Administration are exempt by law from the new drug section of the act.

### For Safe Use of a Drug

The application should contain detailed reports of well-planned animal and clinical experiments. Data of the following type are important: the age, sex, and pathological condition of the subject; the dose of the drug used; the frequency and duration of administration; the results of clinical and laboratory examinations; the nature and incidence of adverse effects; and the therapeutic results.

Animal studies are usually considered necessary, particularly if the product contains an ingredient new to therapeutics. These studies demonstrate the nature of the pharmacological action of the drugs and also the type of effect

obtained by overdosage. Acute toxicity experiments yield a measure of the therapeutic index or safety margin. Subacute and chronic experiments with hematological examinations and histopathological studies give additional information in this connection. The clinical investigator may be expected to demand reports of such studies before he uses the drug on patients.

The type of investigation, both animal and clinical, should be determined by the proposed use of the drug with respect to method and duration of administration. A drug which is recommended for the treatment of chronic conditions such as arthritis, epilepsy, or parkinsonism will require animal toxicity studies of prolonged duration. Shorter toxicity studies would suffice for a drug such as a general anesthetic for use in a single administration. Likewise, a chemotherapeutic agent indicated for the treatment of an acute infection would be used only for a few days to a week or so and, consequently, would not require prolonged animal toxicity studies. Drugs for topical application, such as ointments, lotions, and topical anesthetics and antiseptics, should include studies on their potentiality to produce primary irritation and sensitization. Information on the degree of absorption from skin or mucous membranes may also be indicated when there is a question of systemic toxicity.

The application must also include a full list of the components which go into the preparation of the drug even if they do not appear in the final product. Their disclosure is of interest from the standpoint of their possible retention as impurities in the finished preparation. A complete quantitative statement of the composition of the drug is an obvious requirement. A description of the manufacturing methods and control procedures used in producing the new drug is required to provide the assurance that a preparation of definite specifications with respect to identity, strength, quality, and purity will be produced.

A sample of the drug may be required with the application, and completed market packages are required as they become available. Finally, copies of the proposed labeling must be furnished as part of the application since the safety of the drug must be evaluated on the

basis of all the conditions under which it is recommended for use.

If the New Drug Branch is satisfied that the drug will be safe when used as proposed, the application is allowed to become effective, which means that permission is granted for distribution of the new drug in interstate commerce.

### Marketing New Drugs

Since a drug retains its new drug status for some time after initial distribution, its use under actual marketing conditions is a further test of safety and usually a more severe test than the carefully supervised investigative studies. The general distribution of a drug which appears safe on the basis of investigative studies may be followed by reports of effects of an unexpected nature or of a higher incidence of side effects than occurred in preliminary use. Provision is made in the law to suspend an effective application under these conditions if the hazards of use are considered sufficiently serious. Applications have been suspended for this reason.

Much experience has been gained in the new drug section in the 18 years since the act was passed. As of January 31, 1956, applications for new drugs numbered 10,350, and 7,365 became effective. These figures include applications for veterinary medicaments, which account for approximately 18 percent of the applications submitted since July 1, 1954.

The 3,000 applications which did not become effective fall largely into three classes. Approximately 1,800 were incomplete. Some 500 were withdrawn, usually as a result of objections based on inadequate showing of safety. About 600 were not considered to be new drugs and, accordingly, did not require an effective application for marketing. Action is still pending on 100 applications.

The fact that 7,365 applications became effective does not mean that 7,365 new chemical compounds were introduced as therapeutic agents during the 18-year period.

Numerous firms may submit an application for the same drug. Separate applications may be submitted for various dosage forms of the same drug, such as oral preparations and injections. Or, the new drug in combination with a variety of old drugs may account for a num-

ber of applications. Although each application does not represent an entirely new chemical substance, it does represent a distinct effort by both the manufacturer and the Food and Drug Administration to assure that the consumer can use the product with safety.

The distributor, in addition to following the marketing experience of the new drug, frequently has occasion to change the provisions of his effective application. He may find it advisable to modify certain procedures in the manufacturing process, to make changes in the formulation, or to revise the labeling. A revision of the labeling may involve the inclusion of a warning statement or an additional indication for use of the drug, or it may provide for the product to be distributed under the label of another company.

Changes in the effective application may be made by submitting supplements, which are processed in the same manner as the original application. This procedure is in effect as long as the product remains a new drug. In view of the large number of effective applications on file, it is not surprising that the current number of supplementary applications and related correspondence exceeds 4,500 pieces a year.

It is probable that the safety of the new drug would be achieved in most instances without governmental control. The control procedure, however, is justified if it prevents even rare instances of injury by the distribution of drugs. The necessity of additional safeguards was felt in 1938 when the new drug section of the act was introduced. Since that time, the necessity has become still more imperative because of an even more rapid increase in the production of new products with a potentiality for drug use.

### The Calculated Risk

The New Drug Branch has seen the quality of new drug applications improve during the past few years. A concept of adequate investigation of a new drug has been gradually developed by the Food and Drug Administration and by the pharmaceutical companies so that today new drugs are being investigated more thoroughly than ever before. Greater precautions are being taken by the adoption of stricter manufacturing

control procedures to assure the marketing of products of specified potency and adequate purity. The new drug procedure has been instrumental in promoting these achievements.

Such safeguards should justify the physician's reliance on the declared potency and purity of the product he administers or prescribes and should strengthen the patient's trust in the safety of the remedy. In spite of this, certain facts should be kept in mind.

Safety is a relative term. Probably no two drugs are safe to the same degree. The wide variation in individual tolerance to drugs is recognized. Consequently, a wide margin between the effective dose and the toxic dose is essential if the drug is to be safe for the vast majority of potential consumers. The wide margin of safety is particularly necessary for remedies which are not life saving or which are used for conditions amenable to treatment by other methods or drugs that are relatively safe. In contrast, applications may be allowed to become effective for drugs that are known to be dangerous and for which the safety margin is critical. Granting of these applications is considered to be justified only when the drugs are useful as a life-saving or life-prolonging measure in conditions for which there is no safer efficacious remedy.

In the use of drugs which involve a calculated risk, their potentialities for harm are decreased if the physician recognizes that the potentialities exist and takes all possible precautions against adverse occurrences. Usually, care is taken in the labeling of a drug to outline optimal dosage ranges from the standpoint of both efficacy and safety and to include necessary warnings, precautions, and contraindications for its use. Careful labeling can serve its purpose only if it is read. With the introduction of so many new drugs, the physician can become familiar with only a few. Those which he selects, however, should be studied with particular care by taking advantage of all information imparted in the labeling instructions and in the published literature. The physician can contribute significantly to the safety of a new drug by reporting to the Food and Drug Administration, or by publication, any adverse reactions he observes in his practice.

# Certification of Antibiotics

By HENRY WELCH, Ph.D.



It is generally agreed that little if any good is accomplished by wars. Penicillin perhaps is the exception, for its development, rapid availability, and wide use stemmed from the great need for the drug in World War II. Similarly, the antibiotics certification program got its initial impetus because of our entrance into this worldwide conflict.

In 1941 there was insufficient penicillin in the United States to treat a single case, and in 1942 probably not enough to treat a hundred cases. However, by September 1943 there was sufficient penicillin to satisfy the early demands of the Armed Forces of this country and those of our allies.

It was during September 1943, at the request of the Armed Forces and the War Production Board of the United States, that the Food and Drug Administration undertook the testing of each lot of penicillin produced, for potency, sterility, toxicity, pyrogenicity, pH, and moisture content. On the basis of the results obtained by these tests, the lot was either accepted or rejected.

By June 1945 there was sufficient penicillin to satisfy not only the Armed Forces but a great civilian demand as well, and there was an ap-

parent need for a method of control for this important therapeutic agent. On July 6, 1945, the Federal Food, Drug, and Cosmetic Act was amended to require the certification of batches of drugs composed wholly or partly of any kind of penicillin. The Federal Security Administrator, in accordance with the provisions of this amendment, promulgated regulations providing such standards of identity, strength, quality, and purity as would insure the safety and efficacy of penicillin and penicillin preparations.

Under the law, each manufacturer, before distributing a batch of penicillin in interstate commerce, must submit samples of the batch to the Food and Drug Administration for examination and must obtain a certificate showing that it complies with applicable regulations. Each product proposed for certification to the Food and Drug Administration must be shown to be safe and efficacious, this proof being based on actual clinical trial.

In 1947 the Federal Food, Drug, and Cosmetic Act was amended to include streptomycin and its derivatives. In 1949 it was further amended to include aureomycin (chlortetracycline), chloramphenicol (chloromycetin), and bacitracin. Tetracycline, being a derivative of aureomycin, is also certified by the Government.

There have been no amendments to the act since 1949 to require the certification of antibiotics developed since that time. Therefore, all other currently available antibiotics are subject only to the general provisions of the act, unless they are added to one of the antibiotics for which certification is required.

## Growth of the Antibiotics Industry

When penicillin was first produced in the United States, the potency and hence the purity

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*Dr. Welch is director of the Division of Antibiotics, Food and Drug Administration. Since its beginning in 1943, he has been in charge of the FDA's antibiotics certification program. He is a co-author of the books, Antibiotic Therapy (1951) and Principles and Practices of Antibiotic Therapy (1954); the editor of the Manual of Antibiotics (1954); and the editor in chief of the journals, "Antibiotics and Chemotherapy" and "Antibiotic Medicine."*

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was quite low. Early assays of this drug indicated average potency ranges from 100 to 200 units per milligram. The purity of penicillin improved rapidly in the first few years of manufacture, and the crude material, consisting of a dark brown, amorphous powder, gradually changed in color and consistency to a light brown, then yellow, and finally, the white crystalline form. Production amounted to only about 29 pounds in 1943.

When penicillin became available for the civilian population in 1945, the purity of the drug had been improved considerably so that the calcium salt, which was the one used to the greatest extent, had a potency on the order of 1,200 units per milligram. The crystalline drug (sodium penicillin), which soon appeared, had a potency of 1,667 units per milligram.

During the war years and for some time thereafter, 20 manufacturers in this country produced practically the entire world's supply of penicillin. Competition as such did not exist. All that was produced was consumed and the price was high. The Army paid as much as \$20 for each 100,000 units. By contrast, in late 1955 the Army purchased penicillin in vials packed in wooden cases for shipment overseas for 5 cents for each 300,000 units; that is, less than 2 cents per 100,000 units. Competition now is extremely keen, and instead of 20 manufacturers of penicillin, there are only 9. In fact, 4 of these 9 account for some 70 percent of the production. In addition to the 9 manufacturers of penicillin, there are 4 others producing antibiotics. These 13 manufacturers are responsible for the great bulk of the world's supply of these important drugs.

Production of penicillin in this country started an industry that today has a capital worth of about \$1 billion. In less than 15 years a number of other antibiotic drugs have found their way into the therapy of infectious diseases. In table 1 are the 24 antibiotics that have been shown to be clinically useful of the 3,000 to 4,000 that have been described in the literature. In addition to these 24, hundreds of others are awaiting tests on the shelves of those manufacturers still in the antibiotics field.

Changes in production and approximate dollar value of the seven antibiotics that are

Table 1. Clinically useful antibiotics

Antibiotic	Year developed
Penicillin.....	1929-1943
Tyrothricin.....	1939
Streptomycin.....	1943
Bacitracin.....	1945
Chloramphenicol.....	1947
Polymyxin.....	1947
Dihydrostreptomycin.....	1948
Chlortetracycline.....	1948
Neomycin.....	1949
Fumagillin.....	1950
Oxytetracycline.....	1950
Viomycin.....	1950
Nystatin.....	1951
Erythromycin.....	1952
Carbomycin.....	1952
Tetracycline.....	1953
Anisomycin <sup>1</sup> .....	1954
Cycloserine <sup>1</sup> .....	1955
Cathomycin <sup>2</sup> .....	1955
Streptonivicin <sup>2</sup> .....	1955
PA 105 <sup>1</sup> .....	1955
Vancomycin <sup>1</sup> .....	1955
Stylomycin <sup>1</sup> .....	1955
Spiramycin <sup>1</sup> .....	1955

<sup>1</sup> Still under clinical study.

<sup>2</sup> Although isolated from different sources, cathomycin and streptonivicin have been shown to be the same antibiotic.

used to the greatest extent—penicillin, streptomycin, dihydrostreptomycin, and the broad-spectrum antibiotics—are shown in table 2. Only 29 pounds of crude penicillin were produced in 1943, and this amount had a value at the manufacturers' level of about \$3 million. Production increased more than 100 times in 1944. In 1945 the original estimate of 5,000 kg., which was expected to be sufficient to supply the world demand, was exceeded by a considerable amount: Fourteen thousand pounds, or more than 6,000 kg., were produced. Competition in the industry became extremely keen from 1951 on, and although 756,000 pounds were produced in 1953, the dollar value was less than half that of the 636,000 pounds produced in 1951.

The history of the production of streptomycin is not markedly different. The experience in production methods obtained with penicillin resulted in some 3,800 pounds being produced in 1946, the first year that streptomycin was available commercially. This drug, too, when first used was expensive, in the neighborhood of \$15 per gram. The competition in penicillin was re-

flected in the price of streptomycin by 1953, and although 375,000 pounds were produced, 100 times as much as in 1946, the value increased only 3 times.

More than 417,000 pounds of the broad-spectrum drugs were produced in 1953, with an approximate value of \$137 million. In 1954, 410,000 pounds valued at \$150 million were made available.

The broad-spectrum antibiotics and penicillin have uses other than in the prophylaxis and treatment of disease. They are used, for example, in the promotion of animal growth, and in 1954 some 490,000 pounds were produced for feed supplements. The total for all antibiotics in 1954 was some 2,284,000 pounds, with an approximate value at the manufacturers' level of more than \$272 million. According to recent estimates, production was not materially different in 1955.

A large number of antibiotic preparations are now available to the physician in this country. Among those preparations sold in greatest quantity, there are more than 300 available for clinical use. Preparations containing penicillin number 150. There are 38 streptomycin and dihydrostreptomycin preparations, 47 chlortetracycline and tetracycline preparations, 25 oxy-

tetracycline preparations, 15 chloramphenicol preparations, and 27 bacitracin preparations.

### Certification Practices and Principles

At the start of penicillin control in 1943, a group of six technicians of the Food and Drug Administration, in collaboration with other governmental agencies, successfully checked for the Armed Forces all penicillin then produced. The apparatus used was hand built and makeshift to meet the requirements of a group of new methods.

As time went on and new antibiotics came into clinical use, the laboratory force was expanded. New and adequate equipment became available, and by 1950 the staff controlling certifiable antibiotics numbered 80. Instead of milligrams of penicillin worth more than its weight in gold, lots containing hundreds of thousands of vials of penicillin were being assayed, and the glass used for packaging cost more than the drug. Assays were performed on a mass scale with automatic equipment (fig. 1), and special reading devices sped up potency determinations and made them more accurate (fig. 2). Electronic equipment for infrared analysis (fig. 3) and for accurate, automatic temperature determinations (fig. 4) simplified considerably the problems of mass assays.

Since its beginning in 1945, the certification program has been self-sustaining. All equipment is purchased from fees paid by the producers of the certifiable antibiotics. In addition, since it is set up on a cost basis, excess fees are returned quarterly to the manufacturers on a pro rata basis.

Under the certification system a producer of a new antibiotic preparation for which certification is required presents to the Food and Drug Administration clinical data demonstrating the safety and efficacy of his proposed product. If the data are found to be satisfactory, a monograph is prepared establishing standards of identity, strength, quality, and purity. Thereafter, samples of each batch produced are forwarded to the Division of Antibiotics for examination, and a certificate is issued on all batches complying with the standards. At the present time some 20,000 batches of antibiotics and their preparations are examined and certified yearly.

**Table 2. Antibiotic production in the United States, 1943-55**

Year	Antibiotic	Pounds	Approximate value in millions of dollars
1943	Penicillin.....	29	
1944	do.....	3, 200	3
1945	do.....	14, 000	
1951	do.....	636, 000	137
1953	do.....	756, 000	58
1954	do.....	860, 000	63
1946	Streptomycin.....	3, 800	11
1953	Streptomycin and dihydrostreptomycin.	375, 200	35
1954	do.....	494, 000	40
1953	Broad-spectrum <sup>1</sup> .....	417, 600	137
1954	do.....	440, 000	150
1954	Feed supplements <sup>2</sup> .....	490, 000	19
1954	All antibiotics.....	<sup>3</sup> 2, 284, 000	<sup>3</sup> 272
1955	do.....	<sup>3</sup> 2, 400, 000	

<sup>1</sup> Chlortetracycline, oxytetracycline, tetracycline, and chloramphenicol.

<sup>2</sup> The broad-spectrum antibiotics and penicillin.

<sup>3</sup> Estimated.



Antibiotic preparations destined for export are not required to be certified under the certification system. Such preparations are exempt under section 801 (d) of the Federal Food, Drug, and Cosmetic Act, provided they meet the

specifications of the foreign buyer, are not in violation of the laws of the country to which they are to be shipped, and are marked clearly for export. The buyer of the foreign country must require that the certifiable drugs pur-



Figure 1. Preparing agar plates for penicillin assays.

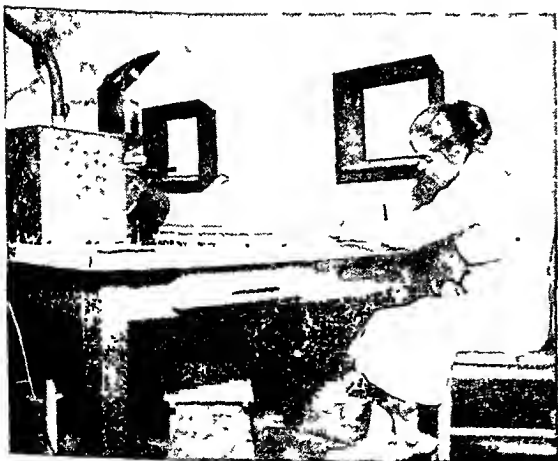


Figure 2. Measuring zones of inhibition to determine potency of antibiotics.



Figure 3. Electronic equipment used for infrared analysis of antibiotics.

chased meet United States Government standards if he wishes to obtain certified material. If he does this, the preparations for export must be sampled, tested, and certified before shipment. Consequently, some of the United States producers certify all of their preparations whether destined for the domestic or export market.

Since July 1945, nearly 300 companies have used the certification services. During this period of approximately 10 years, 150,000 batches of various preparations of penicillin, streptomycin, dihydrostreptomycin, chlortetracycline, tetracycline, chloramphenicol, and bacitracin have been examined. Taking the usual daily dose of these drugs to be 300,000 units for penicillin, 60,000 units for bacitracin, and 1 gram each for streptomycin, dihydrostreptomycin, chlortetracycline, chloramphenicol, and tetracycline, the quantity of these drugs examined represents approximately 7 billion daily doses. The average cost paid by the producers for

certification of each daily dose was 7/100 of a cent. Over 1,000 batches have been either rejected by FDA or withdrawn by the producer because they were substandard. These substandard batches which were prevented from reaching the consumer represent more than 70 million daily doses.

During the past 5 years, the Administrator of the Federal Security Agency, and later the Secretary of the Department of Health, Education, and Welfare, has found that certification of the antibiotic preparations in the list on page 599 is not necessary to insure safety and efficacy. These preparations are now exempt from certification.

### The Impact of Antibiotics

Through use of antibiotics the spectrum of amenable diseases has widened almost yearly. Either completely or partially controlled by the seven antibiotics previously mentioned are



Figure 4. Electronic equipment for automatically determining rectal temperatures of rabbits.

## Antibiotic Preparations Now Exempt From Certification

Crystalline penicillin G sodium.  
Crystalline penicillin G potassium.  
Antibiotics for diagnostic use.  
Antibiotics for fish diseases.  
Antibiotics as preservatives for bull semen.  
Antibiotics as preservatives for biological drugs.  
Antibiotics for use as ingredients of animal feed for certain prescribed conditions.  
Animal feed mixes intended for certain prescribed conditions.  
Buffered crystalline penicillin G sodium.  
Buffered crystalline penicillin G potassium.  
Certain formulations of penicillin troches.  
Certain formulations of bacitracin ointment.  
Streptomycin sulfate granules (powder), oral veterinary.  
Crude chlortetracycline, oral veterinary.

Antibiotics for agricultural use.  
Buffered penicillin powder, oral veterinary.  
Penicillin-streptomycin (penicillin-dihydrostreptomycin) tablets, oral veterinary.  
Penicillin-streptomycin (penicillin-dihydrostreptomycin) powder, oral veterinary.  
Streptomycin (dihydrostreptomycin) for inhalation therapy, veterinary.  
Streptomycin hydrochloride (sulfate) solution, oral veterinary.  
Chlortetracycline (chlortetracycline hydrochloride) powder, veterinary; tetracycline (tetracycline hydrochloride) powder, veterinary.  
Soluble bacitracin methylene disalicylate, oral veterinary.  
Bacitracin powder, oral veterinary.

pneumococcal and streptococcal infections, meningococcal and gonococcal infections, staphylococcal infections, syphilis, yaws, pinta, bejel, Weil's disease, relapsing fever, tropical ulcer, Vincent's angina, and many surgical, urinary, and intestinal tract infections; amebiasis, brucellosis, plague, tularemia, and tuberculosis; and diseases due to certain large viruses and rickettsiae, including primary atypical pneumonia, psittacosis, lymphogranuloma venereum, trachoma, Rocky Mountain spotted fever, epidemic and endemic typhus, scrub typhus, and Q fever. Also largely under control are granuloma inguinale, chancroid, Carrion's disease, pertussis, diphtheria, influenzal meningitis, anthrax, actinomycosis, trichomonas vaginalis vaginitis, and rat bite fever. In addition to use against these specific infections, these antibiotics have found wide use in ophthalmology and in oral surgery and dentistry.

This is indeed an imposing list. However, a second line of defense against a variety of infections is also available. Tyrothricin, bacitracin, polymyxin, neomycin, viomycin, erythromycin, carbomycin, and fumagillin all have a place in the physician's armamentarium. These often prove to be successful where the others fail. Furthermore, antibiotics just becoming available may add new ammunition in the war against infectious diseases.

I think it may be safely said that the antibiotic preparations are used as prescription drugs more frequently in treating serious and crippling diseases than any other drug or class of drugs now available. It has been conservatively estimated that in dollars spent for prescription drugs in recent years, 40 percent of all prescriptions drugs sold include one or more antibiotics.

Thus it is obvious that these drugs are of the greatest importance to the public health and that they deserve a special form of control, such as that established by the certification system. The principle on which certification of these drugs is based appears to be sound; that is, they must be certified because of (a) their great importance to the public health, (b) their use in serious and crippling diseases, (c) the security of a double check on their safety and efficacy given the practicing physician and his patients, and (d) their production by biological means, which may result in vagaries in manufacture and assay. Furthermore, the manufacturer is protected adequately from restrictive or paternalistic control by the principle that an antibiotic shall be exempt from certification when the Secretary of the Department of Health, Education, and Welfare feels that it is no longer in the interest of the public health to continue certification.

# Certification of Insulin

By R. LORIMER GRANT, Ph.D.



Correct dosage is probably more critical for insulin than for any other drug. Most persons with diabetes must take insulin every day, usually injecting it themselves. A dose that is too small may lead to diabetic coma and even death; an overdose may lower the blood sugar to a level that results in an insulin shock. There are about one million known diabetics in the United States today.

These facts explain the public health importance of the Food and Drug Administration's insulin certification program, which is designed to insure, to the extent possible, that every batch of the drug will be safe and effective when used according to directions.

Insulin was the first drug to be certified by the Food and Drug Administration. Certification was not a new procedure—it had been applied to coal-tar colors for many years—but its application to drugs was new when Congress enacted the insulin amendment in December 1941. This amendment prohibits distribution of any batch of an insulin-containing drug until a certificate has been issued stating that the batch is safe and effective.

## History of Insulin Control

The need for special control for insulin by the Food and Drug Administration arose from

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*Dr. Grant, a pharmacologist, is chief of the Insulin Branch, Division of Pharmacology, Food and Drug Administration.*

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the expiration, on December 23, 1941, of one of the insulin patents. Until then, the manufacture of insulin in the United States was regulated by the Insulin Committee of the University of Toronto. Banting and Best had given the patent rights of their discovery to the university, and the university's Board of Governors had then taken out the first insulin patents and set up the Insulin Committee to administer them. The privilege of using these patents, and others subsequently administered by the Insulin Committee, was granted to several manufacturers under licensing agreements.

The purpose of the licensing agreements was to make available insulin-containing drugs of uniform and dependable potency at a minimum cost to the user. The potency of each lot of insulin was established on the basis of biological assay in two independent laboratories. The manufacturer was required to make his own assay of a lot and then to submit a sample of the lot to the insulin control laboratory in Toronto, where a second assay was made. As a further check on uniformity of product, the manufacturer was also required to send to the insulin laboratory samples from every batch of finished drug made from a lot of insulin.

The control of potency afforded by these procedures was commendable, and it was appreciated by all governmental agencies concerned with the safety of drugs. In fact, prior to 1941 the Food and Drug Administration did not have facilities for making a reliable assay of insulin potency because these drugs offered no control problems. Moreover, the Federal law was inadequate to deal with insulin drugs. The only procedure available required collection of a sample from interstate shipment, a

time-consuming assay for potency, and then legal action to prevent further distribution of any drug found to be unsafe. This procedure could result in grave consequences for the consumer.

As the expiration date of the patent approached, several groups, particularly the American Medical Association and the Board of Trustees of the United States Pharmacopeia, sought means to continue the special type of control for insulin that had been provided by the Insulin Committee. E. Fullerton Cook, the director of revision of the pharmacopeia, brought the problem to the attention of the Food and Drug Administration in connection with the drafting of a monograph for insulin injection which was to be admitted to the pharmacopeia after the product patent expired. The Commissioner of Food and Drugs, Walter Campbell, proposed that the pharmacopeia set up an insulin board and establish a laboratory for the testing of the drugs prior to distribution. This plan, similar to that for antianemia preparations, was rejected by the Board of Trustees of the pharmacopeia. Instead, it suggested that the monograph for insulin injection carry a requirement that no lot be released until certified by the Commissioner of Food and Drugs. This proposal was not adopted because it could not be enforced under existing law, but it served to introduce a new idea for Federal control of drugs.

To provide a legal basis for certification, new legislation was needed. Identical bills providing for the certification of drugs composed wholly or partly of insulin were introduced in the House of Representatives on December 16, 1941, and in the Senate on the following day. The bill was passed by the House on December 18 and by the Senate on December 19, and was signed by the President on December 22. This law amended the Food, Drug, and Cosmetic Act of 1938 to require that: (a) all insulin-containing drugs be certified before distribution, (b) regulations be promulgated by the Administrator of the Federal Security Agency providing for this certification on a fee basis, and (c) prior to actual certification of batches, those drugs tested and released by the Insulin Committee be released for distribution.

## The Insulin Regulations

The procedure for certification of insulin drugs is described in regulations published in the Federal Register. The original regulations appeared February 6, 1942. These have been amended as new drugs have been added or as experience has dictated.

All the insulin regulations have been drafted in collaboration with the manufacturers of insulin and with the advice of the Insulin Committee of the University of Toronto. They provide for a continuation of the two-assay control of the potency of each lot of insulin and for the examination of samples from every finished batch by both the manufacturer and the Food and Drug Administration. The tests and methods of assay, as well as the standards to be met, are largely those suggested by the manufacturers of insulin. In other words, the industry sets its own standards, and the Food and Drug Administration enforces them.

The regulations require that the manufacturer do the following in order to have a batch of a drug certified:

1. Describe the production facilities and the controls used to maintain identity, strength, quality, and purity of each batch of drug.
2. Submit to the Food and Drug Administration for its approval a sample of the insulin to be used in the batch before he submits a batch for certification. With this sample he must submit a trial dilution of the insulin and the results of his own biological assay of the insulin. He may also send the results of a biological assay made in the laboratory of the Insulin Committee.
3. If the batch is to contain protamine or globin, obtain approval from the Food and Drug Administration of the ingredient to be used.
4. If the batch is to be protamine zinc insulin, globin zinc insulin, isophane insulin, or lente insulin, obtain approval from the Food and Drug Administration of the trial mixture which will serve as a pattern for future batches of the drug.
5. Submit samples and the results of tests of the finished drug to the Food and Drug Administration.

In administering the provisions of the regu-

lations, the Food and Drug Administration must do the following:

1. From time to time, inspect the factories making insulin-containing drugs, with special attention to the facilities, procedures, and controls applied to insulin.

2. Analyze samples submitted in connection with a request for approval, make biological assays to determine potency, review protocols of the manufacturer and of the Insulin Committee's testing laboratory, and notify the manufacturer of approval or refusal to approve the material for use in making batches of an insulin drug. If approval is refused, the Commissioner of Food and Drugs must tell the manufacturer the reasons.

3. Test samples from every finished batch of an insulin drug before issuing a certificate stating that the batch is safe and effective. These tests always include a determination of nitrogen content, which is an indirect measure of potency, and a check on sterility.

Since the manufacturer has usually completed all of his tests before submitting a sample, refusals to approve or certify are rare. Most cases of refusal to approve have involved the trial mixtures of the slow-acting insulins. The samples submitted in these cases failed to meet all the standards established to insure uniformity in the type and duration of action of the drug. An adjustment in the proportions of ingredients has usually produced a mixture that could be approved. Certification was refused for one batch of protamine zinc insulin that was found to be more alkaline than the permitted limit. This condition was evidently caused by traces of the washing solution used to clean the vials. Samples of one batch contained viable organisms, but the manufacturer found the contamination after submitting the sample and did not complete his request for certification.

As a measure of the effectiveness of control by certification, the Food and Drug Administration investigates every complaint concerning a certified drug. No complaint has been found to be due to a contaminated or faulty batch of an insulin-containing drug. All partly used samples that have been found to contain viable organisms appeared to have been contaminated by the user. No complaint of lack

of potency has been substantiated. Recently, some patients ignored the label warning and used protamine zinc insulin which had become granular. Samples of the same batch kept in proper storage had a normal physical appearance. We believe that all certified insulin-containing drugs are safe and effective when they are used according to the directions on the labeling.

### **Organization of Control**

The responsibility for certification of insulin has been delegated by the Commissioner of Food and Drugs to the Division of Pharmacology and specifically to the Insulin Branch of that division. The staff of the Insulin Branch consists of the branch chief, one chemist, two laboratory technicians, and one secretary. Laboratory facilities include one animal room, where the rabbit colony is housed and the bioassays are conducted; one chemical laboratory, where routine tests of samples are made; and the combined laboratory and office of the branch chief. These laboratories are equipped and maintained and the staff of the branch is paid from the fees collected from the manufacturers who use the certification service.

The fees for the different services vary, but the major portion of the income is from the fixed fees for certification of batches of finished products. The fee for a single batch is determined by the number of samples submitted for test. At the present time, the cost to the manufacturer is \$50 for batches containing up to 50,000 vials plus \$10 for each additional 10,000 vials in the batch. Any excess of income from the fixed fees over the cost of maintaining the service is refunded. Some fees depend upon the cost of the services. For services that require the use of the animal colony, most of the fee is attributable to the cost of maintaining the colony. For instance, the present cost of a biological assay for potency is approximately \$1,200, more than half of which is for maintaining the animal colony.

### **Biological Assay Procedures**

The most important test required for the certification of insulin is the biological assay for

potency. The potency may be determined by a number of methods, all of which involve a comparison of the drug being tested with a standard insulin. The methods used by the Food and Drug Administration have been the variations of the rabbit method currently official in the United States Pharmacopeia. The U.S.P. XII method required almost 1,000 determinations of blood sugar and two 5-day work weeks for completion. The test now official (U.S.P. XV) is greatly improved. It can be completed in 1 work week, and the confidence limits of the results can be calculated. It is possible, when the responses of the animals are very uniform, to make only 96 blood sugar determinations for a suitable assay, but the usual number is nearly 300.

As with all biological assays, the reliability of the assay of insulin depends on the extent of variation in response of the animals. To obtain

the best results, unsuitable animals must be discarded from the colony. It is therefore essential to have an animal colony that is used exclusively for the assay of insulin and to maintain it in readiness to assay any sample submitted. A chemical method for determining potency would reduce considerably the cost and probably would increase the precision of the results, but our knowledge of the chemical structure of insulin indicates that some entirely new technique will be needed before we realize this goal.

It may appear that certification, while affording maximum protection for the user of insulin, substantially increases the cost of this essential drug and thereby adds to the burden of the consumer. However, we have calculated that the total fees collected by the Food and Drug Administration for insulin certification since the beginning of the program average less than three-tenths of a cent for each vial certified.

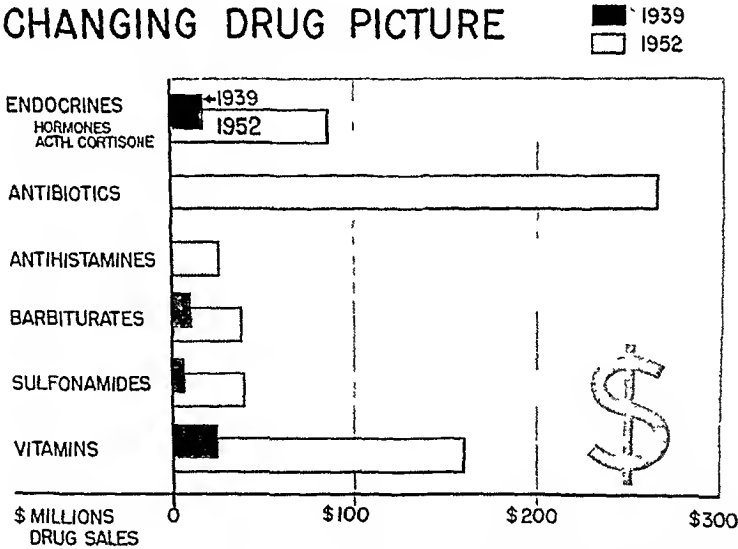


Chart from the Food and Drug Administration

Drug sales reflect advances in biochemistry. Approximately half of the total dollar value of prescriptions written today goes into antibiotics unknown in 1939. The sales of endocrines have grown from \$10 million to more than \$90 million. Antihis-

tamines, unknown in 1939, have sales exceeding \$25 million. Barbiturate sales have more than tripled. Sulfonamides have multiplied eightfold, and vitamin sales have increased about sixfold. Drug consumption as a whole has greatly expanded.

*An assessment of the serologic response to poliomyelitis vaccine in children, following passive immunization with gamma globulin, and in tuberculous children.*

## Poliomyelitis Vaccine Studies

By GORDON C. BROWN, Sc.D., ALAN S. RABSON, M.D.,  
and DONALD E. CRAIG, Ph.D.

THE RECENT demonstration of the effectiveness of the Salk poliomyelitis vaccine in actual field trials in children (1) has concentrated interest on active immunization in controlling poliomyelitis. Nevertheless, the use of passive immunization in the form of gamma globulin (2, 3) may be indicated under circumstances requiring rapid protection. Since the action of the immune blood serum is almost immediate, but of short duration, it should be possible to combine this effect with the slower but longer lasting active immunity obtained with the vaccine. Before such passive-active immunization procedures are used, however, information must be obtained that the administration of gamma globulin does not

interfere with artificially acquired active immunity.

Previous reports from the virus laboratory of the University of Michigan (4) have shown that gamma globulin does not prevent naturally acquired subclinical infection in human beings or the subsequent development of type-specific antibodies. Mixtures of antipoliomyelitis serum and virus have previously been reported to have very little antigenic effect in animals (5-8), but this was probably due to the fact that the virus was actually neutralized before inoculation.

Early work with virus and immune blood serum administered separately indicated that monkeys could be immunized in this manner although the techniques utilized were hardly adequate for the quantitative measurements attempted by the authors (9-11). More recently, Bodian (8) has described experiments in monkeys receiving gamma globulin in one leg and live virus in the other leg, and concluded that there was no interference with the antigenicity of the vaccine. Howe (12) found that a formalin-inactivated brain tissue vaccine was antigenic in a small number of humans when gamma globulin was inoculated at another site, but none of his subjects received the vaccine without the blood derivative.

The purpose of this paper is to report the

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*Dr. Brown is professor of epidemiology and Dr. Craig is a research associate at the virus laboratory, department of epidemiology, University of Michigan School of Public Health. Dr. Rabson is a former epidemic intelligence officer, Communicable Disease Center, Public Health Service, Atlanta, Ga. Their studies were aided by a grant from the National Foundation for Infantile Paralysis and by the assistance and cooperation of Dr. Edna M. Jones, associate physician, Maybury Sanatorium, and of the staff of the Wayne County Training School.*

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serologic results in children given gamma globulin 3 days prior to the administration of poliomyelitis vaccine, and, in addition, to describe the results of control administrations of the same vaccine to children hospitalized with tuberculosis.

## Materials and Methods

During the summer of 1954 a small quantity of poliomyelitis vaccine was made available for research purposes through the courtesy of Dr. Jonas E. Salk. This particular lot of material (lot 309) had in fact been used in some areas for the nationwide field trial in 1954, but only as a third dose in conjunction with other lots. It was also used later in the summer and fall of that year in a separate study of infants and preschool children (13) during which it was discovered that, after this additional time of exposure to the merthiolate preservative, an unfortunate loss of antigenicity had occurred.

For most of the children in the present studies, the poliomyelitis vaccine was administered according to the same schedule used in the 1954 field trial; namely, 3 injections of 1.0 ml. each were given intramuscularly in the left deltoid muscle. The second injection was given 1 week after the first. The third injection was given 5 weeks after the first. A small group of children, however, received only 2 inoculations. The second inoculation was given at an interval of 8 to 10 weeks after the first.

When gamma globulin was used, it was ad-

ministered intramuscularly in the gluteus maximus in quantities of 0.28 ml. per pound of body weight. The globulin was from the same lot (lot 212) used in a previous study (4) in which maximal levels of circulating antibodies were observed in 3 days and persisted for no longer than 3 weeks following this dosage.

## Passive-Active Immunization

In June 1954, 27 boys, ranging in age from 8 to 10 years, at the Wayne County Training School, Northville, Mich., volunteered for the study. First, blood specimens were taken, then the boys were weighed and inoculated with gamma globulin as described. Three days later they received the first of 3 injections of vaccine. Blood specimens were taken 2 weeks after the last inoculation, or 7 weeks after the first injection. The serums were separated and stored at 4° C. until tested. Neutralization tests were performed by mixing equal volumes of original serum dilutions of 1:4, 1:8, 1:16, 1:64, 1:256, and 1:1024 with the 3 types—type 1 (Mahoney), type 2 (MEF-1), type 3 (Saukett)—of poliomyelitis virus calibrated to yield 100 tissue culture doses per inoculum as calculated by the 50 percent endpoint method ( $TCD_{50}$ ). After the virus-serum mixtures had been incubated for 1 hour at room temperature, they were placed in tubes containing cultures of HeLa cells and incubated at 37° C. Appropriate tissue, virus titration, and immune serum controls accompanied each test. Microscopic

Figure 1. Serum antibody titer changes in 27 paired serums taken from Wayne County Training School boys before and after inoculation with gamma globulin and poliomyelitis vaccine.

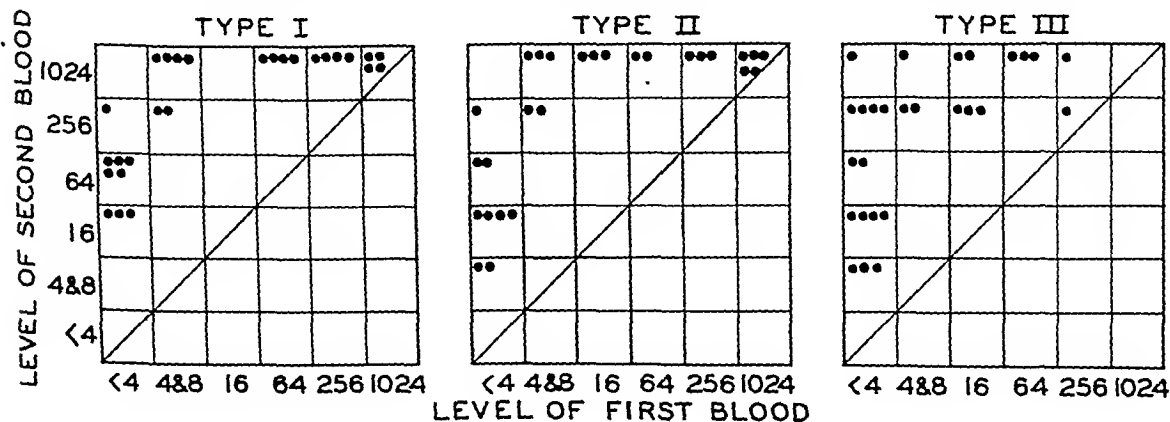
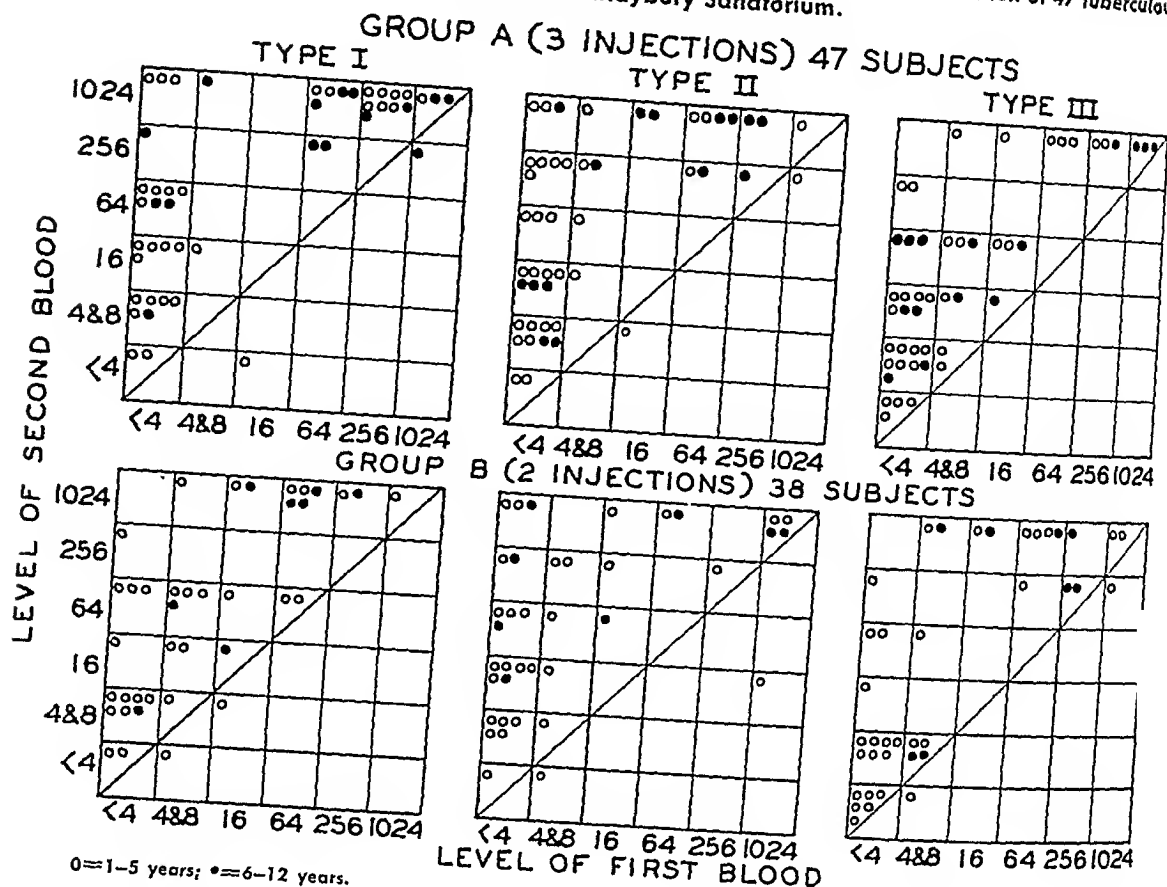


Figure 2. Serum antibody titer changes before and after poliomyelitis vaccination of 47 tuberculous children in Maybury Sanatorium.



evidence of cytopathogenicity was accepted as lack of neutralization.

The serologic response of the children who had been inoculated with gamma globulin 3 days before the administration of the first dose of poliomyelitis vaccine is shown in figure 1. In this figure the numerals at the bottom represent serum antibody levels before vaccination, and the numerals at the left indicate the titers after vaccination. Thus, any circle below the diagonal line would represent a drop in titer; any circle in the diagonal line of squares would indicate no change in titer, and any circle above the diagonal shows that the antibody titer has increased to the titer indicated on the coordinates. In spite of the small number of children studied, it is readily apparent that there was a marked increase in the serum antibody titer in most subjects as shown by the predominance of circles above the di-

agonal line. The median response in the children with undetectable antibodies prior to immunization was between 16-fold and 64-fold, with the more marked increase being observed against types 1 and 2 virus.

Most of the postvaccine titers of the children with demonstrable serum antibodies before vaccination reached the limit of the dilutions employed, namely 1:1024, and some of the titers would undoubtedly have been higher had the dilutions been extended. The controls for this experiment are represented in the results that follow.

#### Active Immunization

In June 1954, 85 children hospitalized for tuberculosis in the Maybury Sanatorium of the Detroit City Board of Health at Northville, Mich., were selected for study. These patients

rauged in age from 1 to 12 years with a predominance of children of 1 through 6 years. Most of the children had been nonambulatory for 6 months to a year. Blood specimens were first obtained from all; then vaccine was administered according to two schedules of inoculation.

Forty-seven children received 3 injections of 1 ml. intramuscularly at 0, 1, and 5 weeks, as given to the training school group after gamma globulin injections. Thirty-eight children, however, received only 2 inoculations at an interval of 8 to 10 weeks. Two weeks after the last injection, blood specimens were obtained from all the subjects again, and the serums were filed at 4° C. until tested.

For purposes of clarification, the children receiving 3 inoculations will be classified as belonging to group A and those with only 2 inoculations as group B. Five months after the first inoculation, blood specimens were taken from 21 group A and 25 group B subjects. Ten months after the start of the experiment,

specimens were obtained again from 19 of the children (11 of group A and 8 of group B) who were still in the sanatorium, following which a booster inoculation of vaccine (lot E5721) was given, and blood specimens were taken 3 weeks later. These latter individuals, then, were children who had been studied over a period of approximately 1 year during which time 5 blood specimens had been obtained, before and after primary and secondary inoculations. All serums were tested for neutralizing antibodies, as described previously.

Figure 2 presents the serum antibody changes in the tuberculosis patients in Maybury Sanatorium after they received the primary inoculation of the vaccine. The upper part of the figure portrays the changes in the children who received 3 injections (group A), and the lower half shows the results for the group who received 2 injections. It will be seen that regardless of the serum antibody titer prior to vaccination, most of the subjects responded well. Very few persons failed to respond, and

Figure 3. Group A—Composite results of antibody response to standard virus types after 3 injections of Salk vaccine, lot 309.

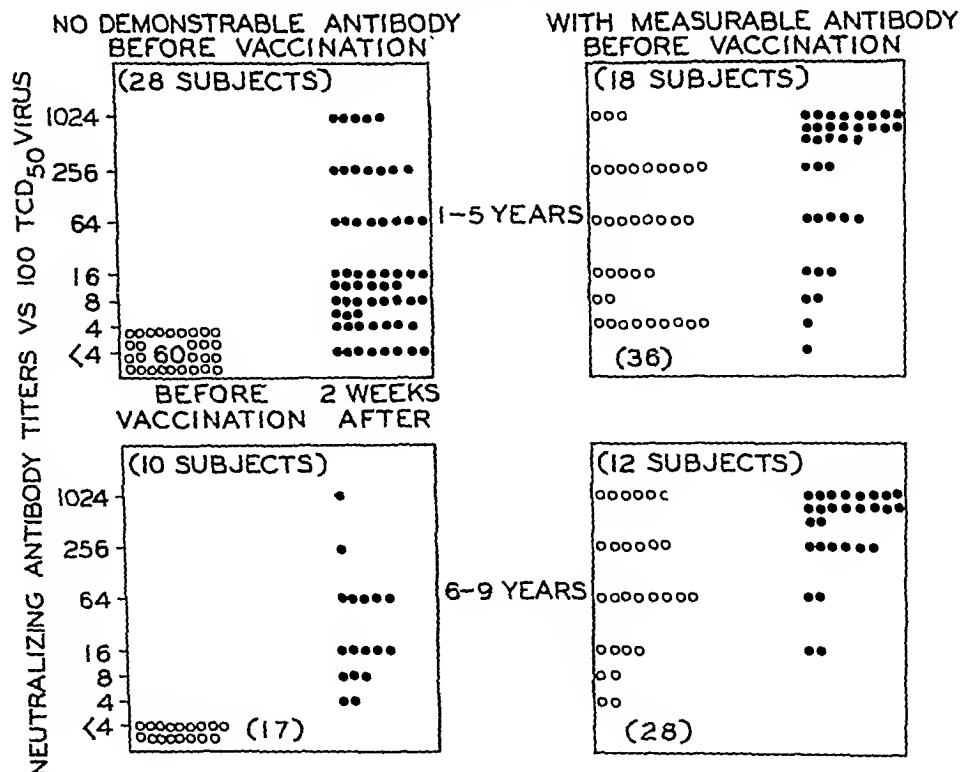
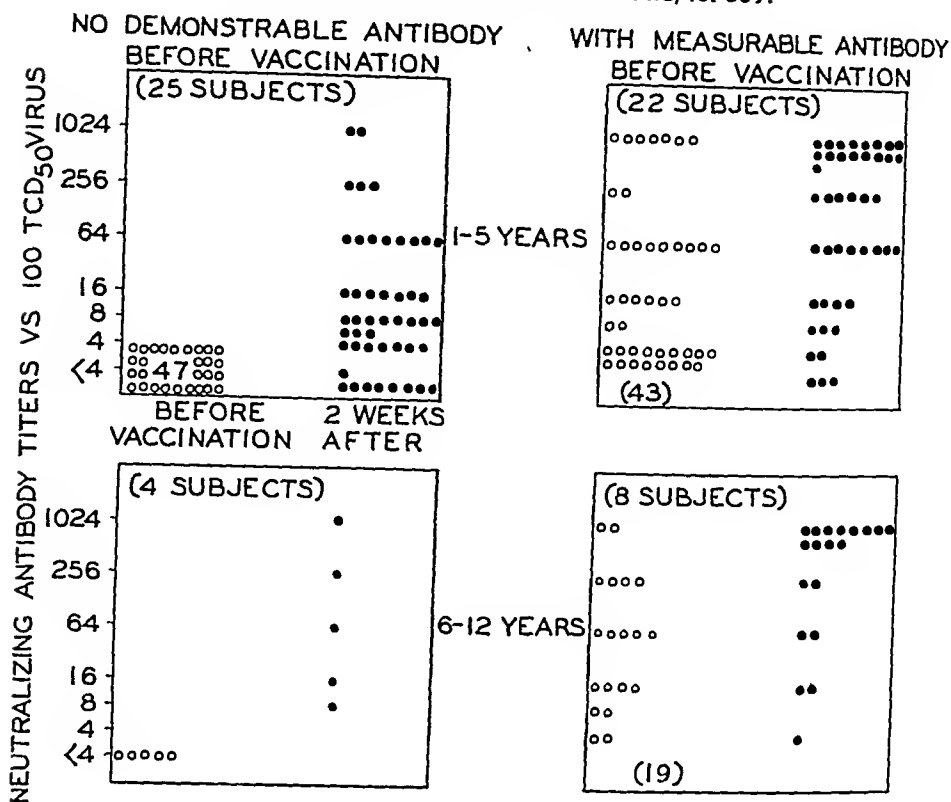


Figure 4. Group B—Composite results of antibody response to standard virus types after 2 injections of Salk vaccine, lot 309.



most of the failures are related to the type 3 component of the vaccine.

The data on the 47 children receiving 3 inoculations are reorganized as composite charts in figure 3, illustrating the development of demonstrable antibodies where none could be detected prior to vaccination and also portraying the results in the children who had antibodies before vaccination. In each of the four charts the antibody levels before vaccination are shown on the left, and the levels 2 weeks after vaccination are shown in the right-hand column. Thirty-two of the children were from 1 to 5 years of age, and, with the exception of one 12-year-old, the other 15 were from 6 to 9 years old. Thirteen children in the 1- to 5-year group had no demonstrable antibodies to any type of virus; 6 had antibodies to only 1 type; 9 had antibodies to 2 types, and only 4 had antibodies to all 3 types. Twenty-eight subjects were lacking in demonstrable antibodies to either one, two, or to all three types of virus, and the

60 such instances with the titers obtained after vaccination are shown in the upper left portion of the composite chart (fig. 3). A median antibody titer of 16 was observed. This duplicates exactly the median antibody response to vaccine in the 10 subjects of the 6- to 9-year age groups having 17 instances of no antibodies before vaccination although the younger age group appeared to have fewer antibodies initially. In those individuals with measurable antibodies to a given type of virus, the increase in the 1- to 5-year age group from a median of 64 before vaccination to a median of 1,024 after vaccination is again duplicated exactly in the older group.

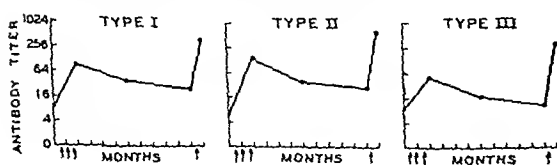
Figure 4 represents the composite results of antibody changes in children receiving only 2 injections of vaccine. Thirty of the subjects were from 1 to 5 years of age, and only 8 were from 6 to 12 years old. Eight children in the 1- to 5-year group had no demonstrable antibodies to any type of virus, 6 had antibodies to only

1 type, 11 had antibodies to 2 types, and only 5 to all 3 types. The composite chart shows that, when antibodies were not present before vaccination, the median rise in homologous titers was eightfold. In the 22 children 1 to 5 years old with 43 instances of demonstrable antibodies to virus (upper right of the chart), the median homologous titers changed from 16 before vaccination to 256 after vaccination, a 16-fold increase. The number of children in the 6- to 12-year age group was too small for accurate analysis, but the antibody increases in these few are obvious and of the same order.

As mentioned previously, blood specimens were obtained from 46 subjects in the study 5 months after the first inoculation of vaccine. Neutralization tests with these serums showed a median fall in antibody titer against all 3 types of virus regardless of whether the children had received two or three inoculations. The decrease was most marked in the type 1 antibodies and least in the type 3. The primary response to the latter had been less, however. This progressive decrease in measurable antibody is further emphasized in figure 5, which shows the geometric mean of the antibody levels in a series of 5 serums taken over a period of almost a year in those subjects who received 3 inoculations of vaccine at the times indicated by the first 3 arrows and a subsequent inoculation 10 months after the start of primary immunization, as indicated by the single arrow.

The tests revealed a good primary response to vaccination, followed by the gradual decline over the intervening 10 months to a point only slightly greater than that seen before vaccination. The effect of the secondary inoculation in these children, however, was quite pronounced and might have been numerically greater had the test dilutions been extended

**Figure 5.** Geometric mean of antibody level in 19 tuberculous children (groups A and B, Maybury Sanatorium) bled 5 times during interval from before vaccination to after receiving poliomyelitis booster injection.



tibodies before inoculation shows that children hospitalized for tuberculosis are equally as good subjects for immunization as are normal children. In fact, the importance of immunizing institutionalized persons is emphasized by the frequency with which epidemics have occurred under such conditions. In this very hospital, 12 cases of poliomyelitis occurred among 80 children in 1952, 2 years prior to this study.

As expected, there appeared to be no correlation whatsoever between the individual antibody responses and the character or extent of the tuberculosis. Furthermore, the response of the young children between 1 and 5 years of age was judged as good as that of the older children regardless of whether they received 2 or 3 inoculations of vaccine. This important observation of the efficacy of vaccine in the younger age group is a forerunner of more extensive data representing studies in infants and preschool children (13) to be published soon from this laboratory.

The gradual decrease in antibody titer during the period following primary vaccination has been described elsewhere (14-16), but the sharp booster effect of subsequent inoculations in the individuals in this study not only demonstrates the beneficial effect of the booster but suggests strongly that, regardless of the level of demonstrable antibodies at that time, significant immunization did persist after the primary stimulation.

### Summary

The serologic response of children inoculated with gamma globulin 3 days prior to active immunization with poliomyelitis vaccine was measured by the virus laboratory, University of Michigan School of Public Health. The consistent rise in antibody titer in the children in the study demonstrates that passive immunization of this extent has no suppressive effect on the individual's response to the vaccine.

The vaccination of children hospitalized for tuberculosis resulted in antibody levels consistent with the response of normal children and indicated that immunization of tuberculous individuals should be practiced. The effect of 2 inoculations was equally as good as that of 3 injections, and no significant difference was

observed in the response of 1- to 5-year old children as compared with that of older children, 6 to 12 years of age.

The booster effect of secondary vaccination almost 1 year later is demonstrated and discussed.

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## Increase in Nuclear Reactors

The number and heat capacity of nuclear reactors in the United States, used to generate electric power, will increase predictably, according to the Division of Sanitary Engineering Services, Public Health Service. There will be a parallel increase in the quantity of radioactive byproducts, it is said, with a corresponding need for protective practices.

The first reactor began operation in 1942. By the end of 1955, there were 22 reactors in operation, with a heat capacity of 100 megawatts. As of February 1956, approximately 40 nuclear reactors, about one-half of which are for the production of nuclear power, were in some stage of design or construction. Seven new reactors, with a heat capacity of 90 megawatts, are expected to begin operation during 1956.

Radioactive wastes from reactors must be segregated or diluted to tolerable concentrations. At present, underground storage and ocean burial are among the methods used or proposed for segregation. Both the economy and the adequacy of these methods are under continuing investigation in anticipation of the probable increase in volume of radioactive wastes.

It is estimated that nuclear power plants completed during 1964 alone will have a power level exceeding  $2.25 \times 10^6$  kilowatts, producing wastes each year of  $3.3 \times 10^{10}$  gallons containing 10 millicuries per gallon. An indication of the magnitude of this activity is that the entire flow of the Mississippi River would not be sufficient to dilute to permissible concentrations the fission products from these plants. Such a method of dilution, of course, is obviously least likely to be used.

# Hospital Problems of Mass Evacuation

By HAROLD M. ERICKSON, M.D.

HOSPITALS, particularly those in target areas to be evacuated, have one of the most important and yet most complex roles of any group in civil defense. Removal of persons who are ill or who are recovering from injury is obviously a much more difficult job than moving able-bodied persons. This, however, is not the only problem of the hospital. Arrangements must be made for continued care of hospital patients either in expanded hospitals at a relatively safe distance from the civil defense impact area or in an emergency hospital. Either or both must be established by the hospital staff with the aid of whatever mobile hospital teams might be available.

Natural disasters as well as manmade disasters may require mass evacuation. Fire, flood, earthquakes, tornadoes, and hurricanes are always with us. One can scarcely pick up a newspaper or turn on a news broadcast without hearing of a disaster some place in the world.

No hospital is free from the possibility of having to evacuate, and, certainly, every hospital may be involved with the care of patients who have been evacuated or with those who become ill or are injured during an evacuation.

During "operation greenlight," a practice evacuation in Portland, Oreg., in 1955, 100,000 persons were evacuated from the downtown area in 34 minutes. This shows what can be accomplished through careful, advance planning. But it was not a test for Portland hospitals since none of them were evacuated.

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*Dr. Erickson, Oregon State health officer, delivered this paper at a meeting of the Oregon Association of Hospitals in October 1955 at Gearhart, Oreg.*

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Imagine a real alert at 3:00 o'clock in the morning instead of 3:00 in the afternoon, with a howling wind and heavy rain falling and darkness blanketing the area. What would happen at the hospital? Most of the Portland hospital administrators would probably be at their homes fast asleep. On awakening, what would be the administrator's first thought? Could he reach the hospital? If not, who would be in charge? Is there a plan for evacuation that is well known to all of the staff, or would chaos develop and removal of patients be impossible because there had been no advance planning?

An evacuation experienced in Oregon during the Vanport flood in 1948 will illustrate what can happen in a disaster. Fortunately, the Vanport Hospital had been evacuated in advance, but some 15,000 to 20,000 people were still housed in Vanport on that Memorial Day afternoon. In Portland, adjacent to Vanport, several of the Red Cross staff members and I were in the offices of the Multnomah County Chapter of the American Red Cross planning the evacuation of Vanport. The weather was ideal. At 4:00 p. m. our planning was interrupted by word that a railroad fill, holding off the flood waters of the Columbia River, had given way, and the city of Vanport, built to house 40,000 to 50,000 people, was being engulfed by a flood of water.

Pandemonium soon broke loose in the chapter offices. Telephone lines were completely blocked by incoming calls. Volunteers jammed the offices. The first thought of the chapter's medical department was of infants and small children. Milk and baby food were ordered through the chapter, but we were helpless to do much more without communications.

The director of the medical department and



I walked to the offices of the Oregon State Board of Health a few blocks away. In a short time we had a large number of the health department staff on duty. A switchboard operator and eight trunk telephone lines were available to us, but we could not make efficient use of them because we had no communication with the Multnomah County Chapter, and we finally went back to that office. There we learned that a request had come through for 20 physicians to report in the neighborhood of Vanport. We did get calls through to a number of doctors, but to this day I do not know whether they were able to reach the area since the streets and highways in the vicinity, we learned later, were completely blocked both by cars that were fortunate enough to get out of Vanport and by sightseers and others trying to reach the scene. In the excitement, it took only one or two stalled cars to block the limited number of roads out of Vanport. Hundreds of cars were completely flooded over; two-story houses were washed hundreds of feet off their foundations—many of them collapsed. But fortunately, only 19 persons lost their lives. There were very few, if any, injured.

At 10:30 that evening the milk and baby food we had ordered were available for delivery to the shelters. Two nurses and I were designated to make the rounds of the some 20 shelters within Portland. That was an enlightening experience. As we reached the various shelters, we found in most instances that babies as well as other evacuees had been fed. People were lined up for blocks near the shelters—not to receive aid but to offer blankets, clothing, food, and their own homes for housing the evacuees. During the first 2 or 3 days, irrespective of race, the majority of the evacuees were housed in private homes. One school was designated for the care of infants and children who needed special medical and nursing supervision. A number of children had measles and there were other illnesses. One outbreak of food poisoning resulted from hasty preparation of sandwiches and lack of refrigeration facilities in one of the shelters.

In brief, during the first few hours communications and transportation broke down, and the residents of the area were entirely dependent on their own resources. From this

experience, I believe we can rely to a great extent on the ingenuity of people and on volunteers if a disaster is not too great. In this instance, a population of less than 20,000 had all the resources of Portland, a large city of more than 350,000, to give aid. After 48 hours, the American Red Cross, Portland Housing Authority, and many governmental and volunteer agencies together did an outstanding job of rehabilitation.

In New Jersey, the experience of the Perth Amboy General Hospital in two disasters is worth review (1-3). Hospital officials met the first, a munitions explosion on four lighters at the South Amboy docks in 1950, with a plan for emergency accident patients, drawn up the month before. The plan worked moderately well, and, with its flaws remedied, the hospital was really prepared for the second disaster, a railroad wreck in 1951.

Certainly we can profit from experiences in disaster, particularly from the experiences of hospital administrators (1-8). In the hospital reports, one statement appears time and again: "Advance planning for disaster is essential if unnecessary loss of life is to be prevented and the needs of patients are to be taken care of in an emergency; there is no substitute for advance planning.

In an evacuation of the Portland metropolitan area, as in any other city the same size, 500,000 persons would have to be moved out. Portland hospitals would have to transport some 3,000 patients; 1,300 of these would be surgical cases and 300 serious medical cases. There would be approximately 100 obstetrical cases, 150 newborn infants, and perhaps 10 or more premature babies that would require special care. In addition to these, a portion of the 2,500 persons who become ill each day would require hospitalization and would have to be cared for. It is estimated that at least 5,000 persons would require first aid or even hospital care as a result of injuries incurred during the evacuation. An additional 3,000 to 4,000 beds would be needed. All of the supplies and equipment would have to be provided locally, at least during the first 24 hours or so until the hospital supplies stockpiled by the Federal Civil Defense Administration could be made available.

## The Questions

What then are some of the specific problems faced by the hospital administrator? Getting back to the warning at 3:00 a. m. on a stormy night, with 4 to 6 hours expected before an attack, problems would be:

1. How will staff members be notified? Which ones should be called and who should notify them?

2. Which patients are to be evacuated and which must be left because they are in too critical a condition to be moved?

3. Where will the critical patients be moved to in the hospital?

4. Who will be left in attendance?

5. Where will the patients that are being evacuated be transported to?

6. Which patients will walk out of the hospitals and by what route? Where do they report? Who directs their leaving?

7. Will helpless patients be moved by stretcher, litters, or wheelchairs, or will beds be moved?

8. Who accompanies the patient?

9. If power fails, is there provision for emergency lighting? What substitutes are there for power?

10. How do we avert panic?

11. Who sets up the temporary hospital, if that is necessary?

12. Where will supplies and equipment be obtained? Where will staff be obtained?

13. How will the staff and patients be fed?

14. What sanitation facilities will be used?

15. What records are essential?

16. How will relatives and other interested persons be notified?

17. Will mortuary services be available? How will the dead be cared for?

18. Who will assume responsibility for various activities if key persons are not available?

19. Can volunteers be used?

These are some of the questions the administrator of the hospital in the evacuation area would face. The hospital outside of the impact area would have additional problems.

Administrators of the receiving hospitals may be warned that patients are being brought to their hospitals. Without prior planning, however, their first knowledge of evacuation might

be on the arrival of patients. These hospital administrators would face additional problems:

1. How will traffic be controlled outside the hospital and inside the hospital?

2. Where are the keys to the various services?

3. What areas of the nonevacuated hospital are to be used for the screening of patients, first aid, additional surgeries, wards, and other necessary emergency services?

4. Are additional hospital supplies and equipment available? If so, where? How will they be obtained? How transported?

5. Where can additional blood and blood plasma be obtained in an emergency?

6. What will be done about supplies and equipment that are offered to the hospital?

7. How will relatives, visitors, and the press be handled?

8. How will admissions and discharges of patients be handled and recorded?

9. Will orderlies and housekeeping personnel as well as other key personnel have transportation to the hospital?

10. Will staff members and pretrained volunteers have personal identification to allow passage through road blocks and guarded centers?

I'm sure that hospital administrators will think of many more questions that need answers. We all realize that order or chaos in an emergency will depend on whether or not these questions have been considered and plans made in advance. Again, and we cannot emphasize it too often, advance planning is a must.

## Planning Principles

What are some of the principles of planning? Briefly outlined, they are:

1. Anticipate the worst possible disaster that might strike the hospital without completely destroying it and plan for this. The resulting plan will enable the staff to handle lesser disasters more effectively.

2. Cooperative planning is best. Bring as many hospital staff members as possible, including the medical staff, into the planning. Forming the nucleus of the planning group may be the hospital administrator, the medical chief of staff, and the director of nurses. A trained public health worker might be invited to join

this group. Other staff members can be called upon when planning in specific services is required.

3. Develop a simple and flexible plan. You cannot plan for every disaster, but a simple, flexible plan can be easily modified as the exigency demands.

4. Correlate the hospital plan with that of the local civil defense agency, fire department, police department, health department, and other agencies that might be concerned.

5. Plan for communications. Arrange for messenger service and two-way radio as substitutes for the telephone, if it should be out, and have a battery-operated radio set available. In planning notification of staff members, remember that the switchboard operator can call only a limited number of persons. Chain-type calling has proved of value.

6. Provide for emergency lighting, water supply, and sanitation facilities.

7. Consider making available a helicopter landing strip at the hospital or nearby.

8. In stocking supplies, some hospitals that have experienced disasters planned initially on having at least 1 month of supplies on hand. Now, the same hospitals are planning on 2 to 3 months of supplies, which they believe will take care of the average disaster. The issuance of moderate amounts of supplies during the emergency and moving them in boxes has been of value in conservation. Get information on reserve medical supplies and equipment available from other hospitals or medical facilities in a nearby area.

9. Keys labeled for all essential parts of the hospital and placed together in a locked box that is to be opened only in an emergency has been a demonstrated aid.

10. Decide on essential records, their preparation, and routing. Designate a responsible staff member and alternates to list daily evacuable and nonevacuable patients.

11. Arrange for emergency mortuary services.

12. A list of volunteers should be considered. It has been pointed out, however, that unless the volunteers are recruited in advance and trained and oriented as to their function in a disaster, they may be of little use. They may, in fact, be a handicap.

13. Plan emergency housing and feeding for the staff, including volunteers. Determine source of food supplies.

14. Assign in writing responsibilities, duties, and priorities of functions to each staff member and pretrained volunteer, designating as many as five alternates for each key position.

15. Avert panic. Psychiatrists tell us that the best way to prevent panic is to give everyone concerned a job to do, familiarize him with the job, and let him do it in the disaster. Combating rumors and giving people an opportunity to discuss their fears and problems is the best approach to psychiatric first aid.

16. Have a check list. Be sure that all details have been considered.

17. Familiarize the entire hospital staff with the plan.

18. Conduct realistic exercises that are as complete as possible.

19. Review the disaster plan and amend it as needed.

These are some of the general principles—a skeleton outline to be enlarged upon and filled in with many administrative details.

To quote from a conclusion reached at a recent meeting in Chicago called to plan for disaster in schools: "Manmade disaster may come and go, but natural disaster is always with us; let's be prepared."

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# The Biology of Northern Mosquitoes

By W. C. FROHNE, Ph.D.

IN the last 10 years, northern Canada and Alaska, the continent's northwestern defense front, have witnessed a construction boom. In this mosquito-infested arctic wilderness, military bastions, power dams, and metallurgical plants are being erected, and oil fields and mines are being developed. A major handicap to this growth has been the seasonal swarming of mosquitoes.

Both the Canadian and United States Governments have directed scientific studies of these insects to establish their importance to public health and to improve the contributions of entomology to polar medicine.

Canadian entomologists and personnel of the Arctic Health Research Center have pushed back the frontiers of Alaskan insect lore and have provided basic biological contributions to knowledge of mosquitoes. A few years ago they discovered a hitherto unrecognized type of life cycle characteristic of many arctic mosquitoes. This discovery will serve, in conjunction with another well-known cycle, as a framework for this discussion.

The role of the northern biting Diptera, including mosquitoes, as disease vectors is largely unexplored. No one has undertaken even a pioneering general survey of pathogens associated with northern mosquitoes. Polar medical entomology today is reminiscent of the status of tropical medical entomology 60 years ago. However, studies of mosquito-borne encephalitis are progressing in Saskatchewan. In Sweden, *Aedes cinereus*, a mosquito abun-

dant in Alaska as well, was recently shown to spread tularemia. Also, in subarctic Siberia, Russians have demonstrated that mosquitoes transmit malaria and Japanese B encephalitis.

Research on disease agents associated with man and mosquitoes in the far north might reveal important pathogenic counterparts to those in temperate and tropical zones, including many only recently detected. However, at present, northern Diptera are regarded primarily as biting, bloodsucking pests.

## Northern Biting Insects

In Alaska and other northern countries, the Diptera include the most offensive insect species. Of all bloodsuckers, the more than two dozen mosquito species are the worst.

We omit lesser offenders, of which the major groups are: (a) Heleidae, punkies or no-see-ums, about 12 species, half of them undescribed, of the genus *Culicoides*; (b) Simuliidae, or blackflies, of 36 described species; (c) Leptidae, or snipeflies, 2 redoubtable, little-known species of *Symphoromyia* resembling horseflies; (d) Tabanidae, horseflies and deerflies, an uncertain number of forms, perhaps 20. Like the better known mosquitoes, the punkies and flies are important because the females bite man.

## Need for Mosquito Control

Following the lead of military medicine, and especially the counsel of the late Dr. Joseph Mountain of the Public Health Service, health workers accept mosquito abatement as adjunct public health. Culicidology is one of the acknowledged health sciences.

During Alaska's summer, hordes of mosqui-

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*Dr. Frohne is chief, Entomology Activities, Arctic Health Research Center, Public Health Service, Anchorage, Alaska.*

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This welcome article brings together diverse information, some of it quite new, about the insect fauna of the far north, more information than has been assembled in one place before. It also highlights the paucity of our knowledge about these species, which are such powerful deterrents to the development of Alaska and which must be subdued if the natural resources of that vast land are to be exploited.

Virtually nothing is known about the disease-vectoring potentialities of arctic biting insects. Indeed, little has been learned about their feeding habits. It seems unlikely that the insects could transmit disease unless they engorged with blood at least twice, with the last feeding upon man. Single broodedness seems to be the rule among the northern mosquitoes. This suggests the probability of single feedings. Yet some of the mosquitoes live more than a year, and it would seem necessary for them to have more than one blood meal to sustain

normal metabolic activities even though much of the time is spent in hibernation. Probably many, if not all, hematophagous species do feed more than once.

But whether these creatures spread disease from lower animals to man, or from man to man, or whether they have nothing whatever to do with spreading disease, their overpowering numbers and vicious biting habits make insect control an almost necessary prelude to land development. To imply that they are unimportant from a health standpoint simply because they are not known to transmit infectious organisms is to discredit the basic tenet of the World Health Organization Charter. Thus, insect control becomes an essential function of health organizations in bringing about relief from severe insect pestiferousness.

—By JUSTIN M. ANDREWS, Sc.D., *associate chief for program, Bureau of State Services, Public Health Service.*

toes attack every exposed warm-blooded animal. Certain mammals, for example the caribou, make long annual migrations to escape them. As for man, it may well be that mosquitoes more than maladies have impeded settlement of the vast and beautiful Alaskan central valleys blessed with fish, timber, and cultivable soil.

In accordance with an ecologic principle that toward the poles species increase quantitatively but decrease qualitatively, myriads of mosquitoes of a few arctic kinds attain densities rarely approached in warmer parts of the world. Man survives the polar winter by protecting himself from frost, the summer, only by antimosquito measures. Evidently, scientific control of arctic mosquito pests is needed to facilitate orderly development of Alaskan resources.

### Life Cycle Types

To compare arctic mosquitoes with those in warmer latitudes, it is unnecessary to present the customary annotated list introducing the 20-odd *Aedes*, 5 or 6 *Culiseta*, 1 *Anopheles*, and 1 *Culex* which comprise the Alaskan mosquito

fauna. Someone might be misled by apparent similarities of the Alaskan assemblage of species to stateside lists. The Alaskan list is a selected biota of peculiarly cold-tolerant forms. All belong to one or the other of two dissimilar types of northern life cycles.

Alaskan mosquitoes are invariably single brooded; there is but one generation per year. The three many-brooded life cycles characteristic of almost all mosquitoes of the United States do not occur at all, so far as is known, in the Territory.

The members of a life cycle type resemble each other in essential habits, but the species do not necessarily belong to the same genus. However, one of the northern life cycles does comprise all the species of *Aedes*. The other includes a taxonomic miscellany of the three other genera. It is sound ecology and helpful toward understanding their biologies to classify the mosquitoes by life cycle type rather than to view them as a list of scientific names.

The *Culiseta impatiens* type of life cycle was recognized as new, by the Arctic Health Research Center laboratory, from the peculiar habits of the long-lived females of a captive colony, the first such colony of northern mos-

quitoes to be established (1). It was designated the *C. impatiens* type when single broodedness and obligatory hibernation of the female, a new combination, were proved. No temperate or tropical mosquito biologies like this have been described.

Some authors have observed the nonbiting habit of first-season females, others the viciousness of second-season hibernators of this species, and as a result the literature is cluttered with contradictory appraisals of *C. impatiens* as a pest.

It was soon obvious, from otherwise puzzling field data, that *Culiseta alaskaensis*, as well as the local *Anopheles* and *Culex*, shares the new type of life cycle (2). In this cycle the habits of females are sharply divided between the two summers they live. Courtship and mating take place the first summer, engorgement and oviposition the second. An adult *C. impatiens* female survives 10 or 12 months. After mating, the females find shelter for diapause. This rest period of estivation and hibernation lasts as long as 10 months in nature; it is as brief as  $3\frac{1}{2}$  or 4 months in the laboratory colony where it ends abruptly with many females spontaneously rousing to seek blood.

Normally, the blood lust appears concomitantly with increasing light in early spring, and the hibernators will bite at near freezing temperatures in order to develop and lay the egg rafts about 2 weeks later. The comparable preoviposition period of *C. alaskaensis*, however, averages much longer, 32.1 days. In both instances the preoviposition periods are unprecedentedly extended as contrasted with those of temperate zone mosquitoes. *Culiseta inornata* of the northern United States requires only 5.3 days (3). Many tropical *Anopheles* actually engorge, develop, and lay eggs all within a 24-hour period.

The preoviposition periods of *C. impatiens* and *C. alaskaensis* were not curtailed under experimental conditions at temperatures above 20° C. Such abnormal warmth merely caused excessive mortality. Eggs, larvae, and pupae of forms subject to the *C. impatiens* cycle develop without diapause in relatively warm permanent or semipermanent waters.

Another cycle characteristic of all Alaskan northern *Aedes* was made known by Wesenberg-

Lund of Denmark 35 years ago (4). He designated it the *A. cinereus* cycle. Hibernation takes place in the egg, and all the forms are obligatorily single brooded. Larvae, and sometimes the pupae, tolerate cold well. *Aedes communis*, for instance, can develop normally in water as cold as 2°–3° C. Females of this type mate, engorge, and oviposit within a few weeks after emergence in May or June. Eggs are laid in drying basins of vernal pools or along the dried margins of less transient standing waters.

### Cold Resistance

Pronounced cold resistance characterizes winter and spring stages of northern mosquitoes, namely, the eggs of *Aedes* and the adult females of other genera. At these stages the pests withstand months of heavy frost and the fluctuating temperatures of spring breakup. Activities of the adult hibernators are also surprisingly independent of moderate cold above freezing. *C. impatiens* females have been observed in January and February frisking on the wing and resting on the snow.

However, specific differences of degree of cold tolerance significantly distinguish the less adapted stages in both cycles. The score or so of *Aedes* can be arranged naturally in serial order based on water temperatures typical for a critical advance in stage: (a) temperatures at which the eggs hatch; (b) temperatures characteristic of mass pupation; (c) the seasonal order of appearance of the species on the wing. Whether the criteria used be (a), (b), or (c), the resulting arrangement is practically the same. Larvae of the earliest species may precede the latest in subarctic Alaska by 2 months (5). Thus the observer dips the former from bleak snow-melt pools after cracking the ice cover of the preceding night, whereas he encounters the latter during the bright, warm days of lush new foliage in early summer.

However, surveys which classify mosquito species according to breeding area, region, and elevation rather than by collection data are particularly instructive. Lumped records for a given species from different habitats may be deceptive where there is thermal individuality dependent on size, exposure, source, and depth of breeding waters as well as their altitude and

latitude. Unexpected contrasts in optimal temperature ranges sometimes isolate the most closely related species. For example, *A. communis*, one of the earliest larvae thriving in the lowest temperature range is nevertheless close taxonomically to *Aedes pionips*, a late warm-water larva. Larvae of all forms manifesting the *C. impatiens* cycle presumably never tolerate cold as well as any of the *Aedes*, and larval cold tolerance is thus closely bound up with life cycle type. Cold tolerance and cycle type are not only implicated in larval habitat preference, but also in geographic distribution (6).

### Distribution

Geographers define arctic, subarctic, and temperate regions by physical criteria stressing winter cold and latitude, such as January isotherms and distribution of permafrost. To explain insect distribution in Alaska, zoogeographers must emphasize vegetation types and warmth during the all-important summer. Otherwise the terms arctic, subarctic, and temperate have practically no meaning.

The Territory is mountainous, and alpine arctic islands above the low timberline at 1,500–2,000 feet are strewn helter-skelter over temperate and subarctic regions. Moreover, without regard to elevation, there are vast remnant glaciers of the Pleistocene ice sheets which chill “temperate” southeastern Alaska. (These ice sheets never covered the arctic and melted in most of the subarctic at the time they receded from the northern United States about 5,000 years ago.)

For example, although southeastern Alaska is designated “temperate” because of the mild winter climate, its cool summers limit the fauna to hardy forms. In the warmer subarctic, where maximum summer temperatures are 90°–100° F., southerly species, such as sun-loving *Anopheles* occur. Finally, “arctic” treeless tundra extends far into the subarctic in western Alaska and merges with the Aleutian grasslands at the latitude of temperate southeastern Alaska.

In the arctic there are wooded valleys of spruce, willow, and birch representing to the biologist simply subarctic inclusions comparable to the arctic alpine inclusions. In fact,

the “hemiarctic” zone proposed by Rousseau, which means demarcation between arctic and subarctic, may constitute a broad band of transitional parkland (7).

Trees are an important part of the environment to mosquitoes. Culicidologists conveniently designate forest forms “woods” mosquitoes. Species of open country are “tundra” or “prairie” mosquitoes. There is a sound ecologic basis for the practice. As more is learned about the distribution of northern mosquitoes in forest or treeless areas, apparent contradictions are resolved. It is essential to stress local habitats and to soft-pedal climatic regions for progress in understanding distribution. Nevertheless, interesting contrasts of arctic, subarctic, and temperate lists of mosquitoes may be made with reference to their qualitative and quantitative compositions, biologies, seasonal histories, and the practical importance of some species as pests.

### Arctic Fauna

Several excessively abundant so-called dark-legged species of *Aedes*, especially *communis* and tundra forms of the *punctator* complex, are the most important arctic mosquitoes (8, 9). When *Culiseta* occur at all there they are scarce and restricted to wooded valleys. *Culex* and *Anopheles* are absent, and any importance of the *C. impatiens* type of life cycle is academic in the arctic. For this reason, too, the mosquito-biting season lasts less than a month, even though at peak it is probably the most intense in the world.

### Subarctic Fauna

The rich and varied subarctic mosquito fauna contains about 2 dozen species belonging to both of the northern types of single-brooded life cycles. The very large *Culiseta* pests of early spring are joined during May and June by 8 or 9 small dark-legged *Aedes* and later further reinforced and replaced by about as many, typically larger, banded-legged kinds. Two retiring and local *Anopheles* and *Culex* species at their northern limits emerge in midsummer. Over vast areas the mosquito-biting season extends from late April to early August, or nearly 4 months. Mosquito densities are high in the interior valleys and locally along the coast at

months of streams, causing severe pest problems in the flat areas most desirable for human habitation.

### *Temperate Fauna*

The so-called temperate southeastern Alaskan mosquito fauna is rather similar to the subarctic list shortened to a dozen species (10). *C. impatiens* appears early (March) in hordes. *C. alaskaensis* occurs only as far south as Haines, the northern gateway to southeastern Alaska and the sole locality in the region for *Culex*. *Anopheles* is absent, too, so far as known. In compensation, two Californian species of *Culiseta*, *incidens* and *macrackenae*, have entered from the south. Either species may pursue a temperate zone life cycle; be multibrooded or have larval hibernation. Unfortunately, both species are rare and their biologies uncertain in Alaska.

The mosquito-biting season in southeastern Alaska is approximately 5 months, but pest problems are markedly local and are almost always due to forms of the *A. punctor* complex, for example, *Aedes punctodes*, a salt marsh breeder. The dark-legged species with, of course, the *A. cinereus* cycle, thus so predominate that southeastern Alaskan mosquitoes, both taxonomically and biologically, resemble the arctic and subarctic faunas rather than typical temperate zone mosquito faunas.

Mosquitoes of all three life zones in Alaska are different from most stateside mosquitoes, but as they have a great deal in common, it seems logical that they be studied and controlled from a central headquarters in subarctic Alaska.

### **Larval Habitats**

Definition of the typical larval habitats of insects harmful in adult stages facilitates further biological study and makes species sanitation feasible. As an extreme example, for many years Alaskan entomologists have been stymied in studies of the common snipefly pest, *Symphoromyia atripes*. They could not find its breeding places, immature stages, or the males. In 1955, however, the first newly hatched Alaskan *Symphoromyia* appeared in emergence traps put out in mountain meadows for sampling alpine insects. It is at long last reasonable

to anticipate progress in learning the biology and planning the suppression of snipeflies.

In the main, the most harmful Alaskan mosquitoes worthy of special suppression measures include *A. punctor* forms, *communis*, *impiger*, *excrucians*, *fitchii*, *intrudens*, *diantaeus*, and *C. impatiens* and *C. alaskaensis*. It is difficult to be objective quantitatively about culicine larval populations; the common forms are usually listed for the sake of completeness from a wide variety of marginal atypical habitats. However, only favorable habitats, where a species is so abundant as to cause concern, ought to be considered typical. By reasoning so, at any rate, it has been possible for entomologists to characterize the habitat of each Alaskan mosquito, for all practical purposes. Several representative examples of Alaskan mosquito habitats have been described in detail elsewhere (11-13).

### *Quaking Bogs*

Public Health Service entomologists have shown that *Drepanocladus-Carex* quaking bogs are the preferred larval habitat of only one Alaskan *Aedes* (11). In his northern Michigan sphagnum mat-mosquito study, Irwin (12) reported a perplexing wiggler resembling *A. diantaeus*. The new species was described by Smith (13), who discovered it in a Massachusetts quaking bog, and named *Aedes pseudodiantaeus* (now called *Aedes decticus*). It is now practicable to study the biology of *A. decticus* where it abounds in Alaskan quaking bogs.

### *Permanent and Semipermanent Waters*

The characteristic mosquitoes of weedy lake-shores and permanent ponds in Alaska are *Anopheles* and *Culex*. Their specific environmental requirements differ markedly, nevertheless. The sun-loving *Anopheles* occurs in the open, and especially in warmer water than the shade-loving *Culex* which hides in clumps of *Carex* and other sedges.

Dystrophic ponds within bogs are the preferred habitat of *C. impatiens* and *C. alaskaensis*. However, the *C. impatiens* female deposits her raft freely on the open water of weedless basins whereas *C. alaskaensis* oviposits chiefly within dense clumps of dead *Carex*. Consequently it is feasible to predict, in regions where



both species occur, which larva will predominate in a particular pond. *Culiseta morsitans* also breeds in pondlike bog inclusions but primarily in senescent bogs of the *Sphagnum-Ledum-Picea* class which are choked with *Myrica gale* or *Carex*.

### Tundras

In the boggy pools of the vast arctic and subarctic tundra waterscapes, there develop distinct tundra varieties of two species of the *A. punctor* complex. Whatever the taxonomic category to which these perplexing varieties are assigned, they certainly constitute major pests. It was recently shown (14) that the *A. communis* form, breeding in the brushy inclusions of the tundra and alpine meadows, manifests habits not typical of the species. The males are able to swarm for mating in the open treeless wastes even though *A. communis* is typically a "woods" mosquito swarming only in deep shade. Possibly this open-country form should be considered a tundra variety of *A. communis*.

### Salt Marshes

Alaska has an important salt marsh mosquito pest which belongs to the *A. punctor* complex like the principal tundra pests. It breeds in myriads in arctic, subarctic, and temperate brackish coastal marshes. Dyar designated this form *A. punctodes*, and it may be necessary to restore its specific standing when the puzzling *A. punctor* complex becomes better understood. At any rate, the basic knowledge of its biology for settling academic questions and undertaking practical control of salt marsh mosquitoes is now being acquired (15).

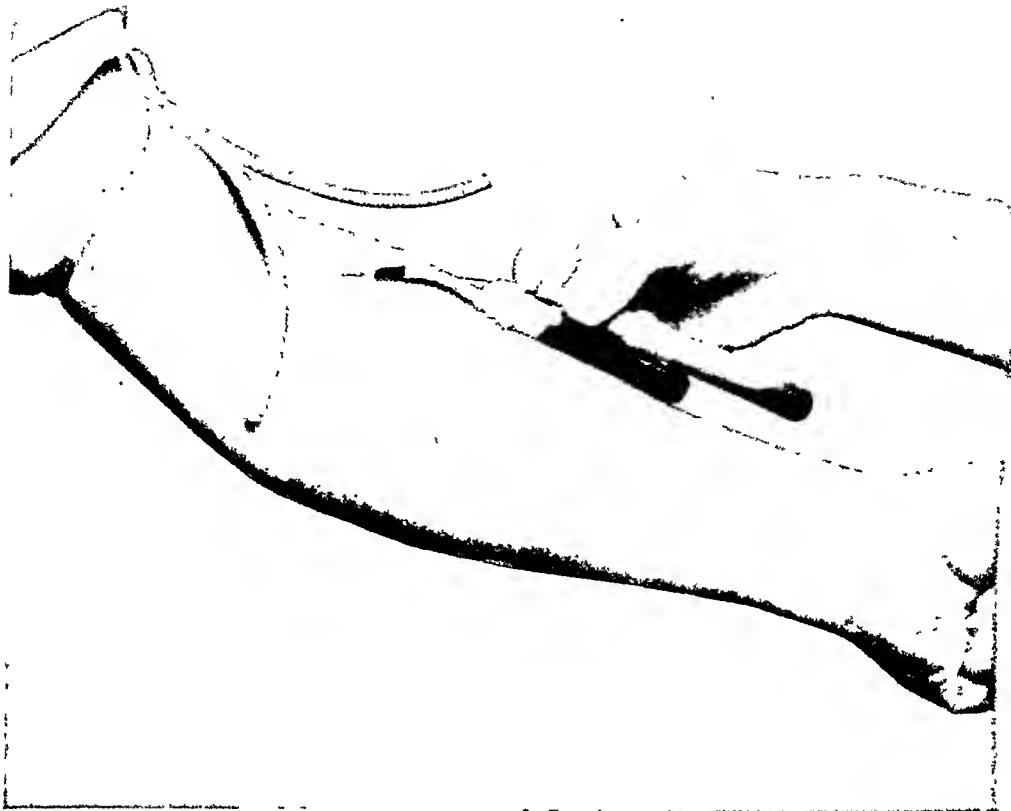
### Summary

Certain general correlations of life cycle with cold-tolerant stages and geographic distribution of mosquitoes in Alaska have been noted. Similarly, there is correlation of habitats with type of cycle. The species belonging to the *Aedes cinereus* cycle breed in temporary waters or the drying margins of semipermanent waters. The earlier species develop in snow water retained by the underlying frost. The later species require water which persists longer. Species of the *Culiseta impatiens* cycle, however, occur only in permanent waters or the most persistent

residual pools of semipermanent waters. There are no Alaskan species known to breed normally either in artificial containers such as tin cans or in treeholes, the water of pitcher plants, or other small collections of water.

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## idea

### *Piggyback Blood Testing*

The Sheppard vacuum-packed blood-testing tube has been used in mass blood-testing programs by many State, county, and city venereal disease programs for the past 5 to 7 years.

The Sheppard tube proved to be a valuable aid to the speed and efficacy of mass blood testing. Occasionally, however, a tube with a faulty vacuum would fail to draw blood, necessitating a second attempt.

Survey workers using the tubes readily developed the technique of

leaving the first needle in the vein and inserting the needle of a second tube into the rubber sleeve of the first, releasing the vacuum and drawing blood into the second tube via the first tube, thereby avoiding a second venipuncture.

The picture above, taken by Dr. Charles M. Cameron, Jr., of the University of North Carolina School of Public Health, shows blood specimens being taken in this manner during the Cherokee Indian Reservation multiphasic survey conducted by the North Carolina State Board of Health in April 1955.

As a result of this experience in the piggyback method of blood drawing, the District of Columbia De-

partment of Public Health has combined both syphilis and diabetes detection in a mass blood-testing program.

Prepacking the second tube with 30 milligrams of sodium fluoride is the only special preparation required for the dual testing. The sodium fluoride acts as a sufficient anticoagulant for 3 cubic centimeters of blood and allows refrigeration storage of the specimen until it reaches the laboratory.

The piggyback blood-testing method was introduced in Washington, D. C., in June 1955 in a house-to-house blood-testing survey. The reaction of the public was, "Two tests for the pain of one is only half bad."

—JOHN L. PENDLETON, U. S. public health representative  
District of Columbia, Department of Public Health.

*no single blueprint but a common pattern . . .*

FOR COMMUNITY ORGANIZATION OF HEALTH SERVICES

AT the annual meeting of the National Advisory Committee on Local Health Departments, sponsored by the National Health Council, the experience of five counties in improving their health facilities illustrated the value of broad citizenship participation in advance planning—for necessary legislative action, for intensive education of the voter, and for continued maintenance of public interest in the operation of established programs.

The meeting in New York City, February 1, 1956, discussed ways of achieving community organization for improving existing health services. Speakers outlined the history of community efforts in Erie County, Pa., Burlington County, N. J., Jackson County, Ohio, Woodford County, Ky., and Saline County, Kans. The 1956 meeting was the third in a series of annual discussions on the problems of development and maintenance of local health services. The two earlier sessions were devoted to the problems of local financing and to community attitudes toward local health services.

In reviewing the committee's 8-year history, Sherwood A. Messner, chairman, traced a trend toward experimentation in health department organization. He pointed to the growing recognition that a single blueprint is not suitable for organizing health department services. Since 1945, 40 city-county health departments have been organized in 16 States. Other States have developed multicounty districts. Some States are following the traditional pattern of a health department for each county. Today there are 1,442 local health units in the Nation.

Close to 100 representatives of national health, welfare, and civic organizations and

official agencies took part in the one-day program.

Discussion brought out that the successful attempt for improving local health services has involved as many citizens as possible in preliminary fact-finding surveys of community needs as well as in the planning of subsequent publicity campaigns; that the support of every community group which might be even remotely concerned should be solicited; that timing of publicity is critical; and that, in general, campaigns should be short and intensive, leading immediately to the ballot box, if voter approval is necessary. Financing of health services appeared to be a minor problem once strong community organizations were actively involved.

#### Build With Voluntary Groups

"We can afford good local health services if only we want them," A. L. Chapman, M.D., medical director, Region II (New York City), Public Health Service, told the meeting.

Dr. Chapman said that people are more interested in supporting "health services" for which they feel a need than in supporting "health departments," about which they know too little. Because modern health services are difficult for the general public to understand, special efforts by community organizations are needed for interpretation of the department's complex activities.

Voluntary groups can be won to support of the health department by helping to develop services in which they have special interest, Dr. Chapman continued. The local health officer must have a talent for organization plus the

ability to educate in the broadest sense and a working knowledge of motivation techniques in order both to gain and then to keep community support, he added.

The importance of building on existing interests which the public already has in health was stressed by other speakers. Discussants agreed that it was vital to maintain public support of the health department after its establishment. Use of a citizens committee to which the department would report annually and publicity about the department's activities in the local press were two of the methods suggested for holding public interest.

### **Community Organization Vignettes**

Case histories of the five counties revealed a common pattern of community organization even if no single blueprint was followed.

#### *Erie County*

Erie County, Pa., where voters in November 1955 approved provisions for a county health department, was represented by Russell B. Roth, M.D., chairman of the new county board of health and former president of the Erie County Medical Society. He told how an intensive publicity campaign put strong emphasis on informing the voters.

A speakers bureau in the Erie County Health Council, which organized and conducted the campaign, used dramatic examples with emotional appeal in talks before all possible local groups.

Dr. Roth emphasized the importance of enlisting the cooperation of trusted community leaders. He stressed the need for factual material pointing up deficiencies in public health.

#### *Burlington County*

Jesses B. Aronson, M.D., district health officer, Central State Health District, New Jersey Department of Health, told how Burlington County, N. J., obtained county nursing services despite community apathy toward improving health services.

With the formation of a citizens group, representing voluntary health and welfare agencies, the medical society, local boards of health, labor organizations, and civic and professional

groups, and with the advice and assistance of the State health department, the Burlington County Public Health Nursing Association was brought into being. The association is a voluntary one, partly subsidized by official agencies. The eventual goal, Dr. Aronson said, is a health department to serve the entire county.

#### *Jackson County*

A volunteer group spearheaded the successful effort to win voter approval of a tax levy to pay for a countywide health department in Jackson County, Ohio. The group conducted a 5-week information campaign, relying heavily on an active speakers bureau, newspapers, and radio.

Stating that too few local medical practitioners participated in the campaign, Mrs. John T. Sellers, vice president of the new Jackson County Board of Health and a director of the Jackson County Tuberculosis Association, questioned whether medical students are receiving an adequate understanding of public health.

Mrs. Sellers pointed to the important work done by local units of national voluntary organizations in surveying the community. Valuable assistance also came from the Ohio State Board of Health. Discussants of her talk suggested that field personnel of national agencies can emphasize to their affiliates the importance of working for local health services. Subsequent suggestions mentioned the possibility of asking affiliated agencies to report such activities in their annual reports to national headquarters.

#### *Woodford County*

Woodford was the last of Kentucky's 120 counties to install a full-time health department. A 65-year struggle by women's clubs to obtain adequate health services in Kentucky was described by Mrs. Sam Flowers, president of the Kentucky Federation of Women's Clubs.

Mrs. Flowers told how speakers appealed for support of the proposed facility at meetings of all possible groups in Woodford County. A citizens health committee was organized and included a planning board which represented all civic organizations. A photographic survey of insanitary health conditions, views of

outdoor privies, and pictures of dirty restaurants were published in the newspapers. Help was given by the Kentucky State Department of Health and by the medical profession. The measure for the new health department failed to pass the fiscal court when first presented but was successful in 1955.

### *Saline County*

After 33 years of frustration, Saline County, Kans., also achieved success in 1955, when community interest in a mental health guidance center sparked the establishment of a countywide health department. Henry C. Huntley, M.D., assistant medical director, Region II (New York City), Public Health Service, reported Saline County's earlier attempts to achieve a county health setup.

### Three Basic Steps

In summing up the group reports, buzz sessions, and discussion periods, Erval R. Coffey, M.D., health officer of Greenwich, Conn., listed three basic steps in sustaining health services:

- Learn the facts about the community and deliver the facts to the public.
- Enlist all groups in the community in the improvement drive.
- Maintain public interest after the initial victory.

The Bulletin on Local Health Units carried a story of the annual meeting in the January-February 1956 issue. The bulletin is published by the National Advisory Committee on Local Health Departments, National Health Council, 1790 Broadway, New York 19, N. Y.

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## technical publications

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### The National Cancer Institute

*Public Health Service Publication No. 138. 1955. 22 pages; illustrated. 20 cents.*

This brochure gives a concise history of the National Cancer Institute of the Public Health Service.

A short review of the present status of the cancer problem is followed by an illustrated account of what the institute is doing—in research, in training, and in control—to help solve the problem of cancer.

About 70 percent of the annual appropriation for the various activities of the institute is devoted to cancer research, and more than two-thirds of the funds are granted to scientists in non-Federal institutions such as universities and hospitals. Other grant categories discussed include financial support for cancer teaching in medical and dental schools, programs designed to aid young physicians and scientists spe-

cializing in cancer work, grants to State health agencies, and field investigation grants directed toward the support of such projects as studies of the incidence of cancer in relation to certain environmental factors.

Discussed are methods used to acquaint practicing physicians and dentists with new developments in the cancer field, consultation services to State health agencies, public health educational programs, the radium loan program, and cooperation with voluntary health agencies interested in the cancer problem.

### Reported Tuberculosis Data Calendar Year 1954

*Public Health Service Publication No. 171. 1955. 29 pages. 25 cents.*

Data are presented for newly reported tuberculosis cases for the United States and each State by

source of morbidity report, activity status, form and extent of the disease, race, sex, and age. Data on X-ray case-finding activities, mortality, and public health nursing visits are also included.

Reports were received from all the States, the District of Columbia, Alaska, Hawaii, and Puerto Rico. An analysis of each table summarizes data for the years 1952, 1953, and 1954 and points out pertinent characteristics inherent in the data.

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This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

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*A preliminary report of a longitudinal study begun in 1952 on epidemiology of oral health in children, covering periodontal systemic conditions, as well as caries.*

# Oral Health Study in Children of Suburban Washington, D. C.

By A. L. RUSSELL, D.D.S., M.P.H.

THIS is a preliminary report on a study of oral health in a population of children as the population becomes progressively less susceptible to dental caries following fluoridation of its community water. The study is not designed as a test of the fluoride-dental caries relationship; the study plan assumes that this relationship is fully established and that a progressive inhibition of dental caries will, in fact, occur. The study's broad and long-term objectives are to augment the descriptive epidemiology of dental caries and to lay a foundation for a descriptive epidemiology of periodontal disease as it first appears in relatively young persons. In addition the study group has been and will be utilized, as a population of known status and background, for short-term observation of pertinent phenomena. Two such reports, based in part upon this population, have already been published (1, 2).

The present report is limited to observations on dental caries. It describes the study population, criteria and methods of examination, and the status of the group at the time of first examination in 1952 and includes summary data

from examinations in 1953 and 1954. Evidence is presented to support other findings that inhibition of dental caries in children will follow use of a fluoridated domestic water. The continuing study is being conducted by the National Institute of Dental Research, Public Health Service, in Prince Georges and Montgomery Counties, Md., two counties adjacent to the District of Columbia.

## The Study Situation

The population of Montgomery County in 1950 numbered 164,401 persons of whom 93.6 percent were white. The population of Prince Georges County was 194,182 persons, 88.2 percent of whom were white.

Both counties are predominantly urban. Only 6.4 percent and 5.9 percent of the residents of the respective counties lived on farms in 1950. The median number of school years completed by persons 25 years of age or older was 12.6 in Montgomery County and 12.0 in Prince Georges County. Median family income was \$4,532 in the one county and \$3,634 in the other (3a). The median value of one-family homes was \$16,136 in Montgomery County and \$11,696 in Prince Georges County (3b). Principal sources of income were Federal employment, wholesale and retail trade, construction, and service occupations. Only about 10 percent of

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the population were employed in manufacturing (4).

Compared with the United States as a whole, residents of the two counties had completed more schooling, had earned higher incomes, and had lived in more expensive homes. For the entire Nation, the median number of school years completed in 1950, by persons 25 years of age or older, was 9.3 years (5a). Median incomes were \$2,970 for urban families, and \$2,186 for rural nonfarm families, respectively (5b). And the median value of a one-family home, in urban and rural nonfarm areas, was \$7,354 (5c).

About 5,000 elementary and junior high school pupils have been examined annually since the oral health study began. The Montgomery County group is taken from an area centering around the Takoma Park Junior High School, adjacent to the District of Columbia across its northeast border. The Prince Georges County group lives in the general vicinity of the Maryland Park and Suitland Junior High Schools, near the southeast border of the District. These areas were chosen as representative of suburban Washington from the socioeconomic standpoint and because their residents have been relatively nonmigratory.

Detailed data concerning the number of topical sodium fluoride treatments were obtained for each child through a schedule completed and returned by his parents. The proportion of treated children was so high in one Montgomery County neighborhood that it seemed prudent to exclude this entire group in computing caries and eruption expectancy tables.

Data for eight schools were analyzed separately by age, sex, and school. Though the proportion of filled teeth to total caries experience was uniformly higher in Montgomery than in Prince Georges County children, all children in the study seemed to have been drawn from the same universe as regards total caries experience in deciduous and permanent teeth and in eruption of permanent teeth and, hence, were combined into one single group for study.

Children in the study group are furnished a fluoridated water by the Washington Suburban Sanitary Commission although at the outset of the study one small group in Prince Georges County used water from wells. Raw water is taken from the Patuxent River and from the

northwest branch of the Anacostia River. The two watersheds drain about 105 square miles to the north and east of the District of Columbia. The raw water receives similar treatment in two processing plants. Treatment includes aeration, prechlorination, flocculation, rapid sand filtration, adjustment of alkalinity with hydrated lime, postchlorination, and the addition of fluoride as sodium fluosilicate by means of dry feeders. With the exception of fluoridation these procedures have been uniform throughout the lives of the children under study. Tap water prior to 1952 was essentially fluoride free.

The fluoride feeders were started on December 28, 1951. During a period of preliminary adjustment, operation was not continuous. For this reason and because of the reservoir of fluoride-free water stored in the system of mains, a fully fluoridated water was not available at all taps throughout the distribution system until the last week of February in 1952. From that time onward, spot tap fluoride determinations carried out by the Washington Suburban Sanitary Commission have been faithful reflections of the daily fluoride levels in finished water at the filtration plants with the exception of a short period in mid-June 1952, when water in the Prince Georges County area was diluted with fluoride-free water obtained through a cross connection with the District of Columbia supply. During that period the fluoride level in the Suitland area dropped to 0.50 p.p.m. F. The District of Columbia supply has since been fluoridated. The average daily fluoride content of finished water at the Robert B. Morse filtration plant, serving generally the Montgomery County study children, was 0.98 p.p.m. F in 1952 and 0.94 p.p.m. F in 1953. The average daily fluoride content of finished water at the Patuxent filtration plant, serving generally the Prince Georges County study children, was 0.90 p.p.m. F over both years.

#### Methods and Criteria

All examinations have been carried out by dental officers of the National Institute of Dental Research. Mouth mirror and explorer are employed, with the child seated in a portable dental chair, under a portable examination

light. Examination results are dictated to a recorder in a code similar to that suggested by Klein and Palmer (6). Some changes have been made in the code to avoid phonetic confusion and to permit the separate notation of pit-and-fissure or smooth-surface carious lesions found on a single tooth surface. Examinations are scheduled so that each child is observed during the same calendar week on successive years.

All criteria are designed to assure the highest practicable degree of comparability among examiners:

None but positive lesions which admit the explorer point are recorded as carious.

Decalcified areas in the gingival third of the labial or buccal surfaces and opacities of marginal ridges which suggest a possible proximal lesion are recorded as questionable and tabulated as normal unless a definite enamel discontinuity is demonstrated with the explorer.

Deep pits and fissures are similarly recorded as questionable unless softened dentin is encountered by the explorer point or there is visible evidence of backward decay at the dentino-enamel junction.

A tooth is considered to be in eruption if any portion protrudes through the gum.

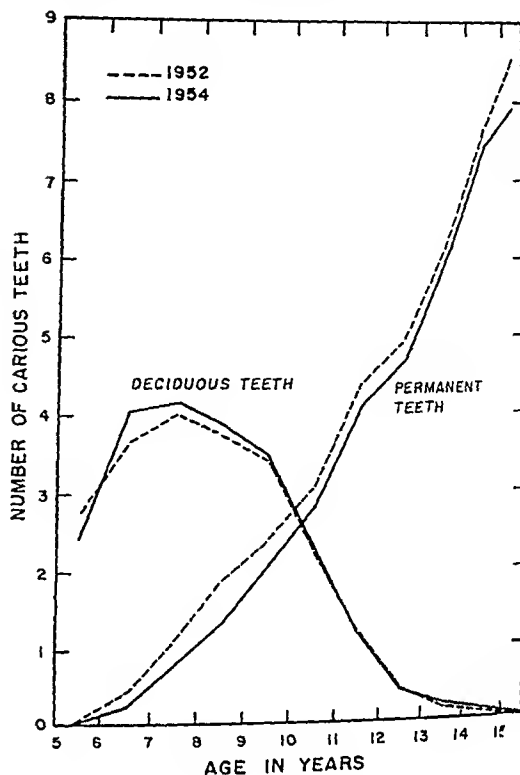
Criteria for the scoring of periodontal disease have been discussed in detail in an earlier report (7).

### Initial Status

A total of 4,737 white children aged 5 through 15 years were examined between December 1951 and February 1952, coincident with the fluoridation of the water supply. The dental caries experience of this group of children is summarized in table 1.

Subsequent study of history records supplied by parents disclosed that 1,950 of these children had been born in and had been continuous residents of the area, except for short vacation trips in some instances, and had not received any treatment designed to prevent dental caries. Findings for this group, designated hereafter as the baseline population, were accepted as representative for children in the general area in the absence of a known caries-

1952 and 1954 caries experience of continuous-residence children of Montgomery and Prince Georges Counties, Md., who had not received caries prevention treatments.



inhibitory factor and were utilized in the construction of a family of expectancy curves for caries increments in teeth and tooth surfaces, the eruption of permanent teeth, and the exuviation of deciduous teeth. Oral findings for these children are presented in broad outline in table 2.

The general caries experience in the baseline group is considerably lower than it was in children examined initially at Grand Rapids (8), and it was somewhat below the caries levels reported at the beginning of the Newburgh and Brantford studies (9, 10). Very similar findings were returned by Arnold and McClure (11) in a study of children aged 12 and 13 years in 1939 and 1940 in Arlington, Va., another suburb of Washington, D. C., and by the Southern Maryland District Dental Society, which examined about 15,000 other children in Montgomery and Prince Georges Counties early in 1952. The findings for this separate group of children are summarized in table 3.



On the basis of these comparisons, the mean number of decayed, missing, or filled (DMF) permanent teeth in baseline children aged 11 years appears to be somewhat high. If this is true, computations of yearly caries increment based on these data will overestimate the true increment between the ages of 10 and 11 years and will underestimate the true increment between the ages of 11 and 12 years.

Table 4 shows crude caries rates for children,

comparable with the baseline group, who were observed in 1952, 1953, and 1954. Findings for caries in permanent teeth in 1953, after 1 year of fluoridation, are in general slightly higher than the findings for the baseline year though the differences are well within the range of chance variation. This has been a common phenomenon in fluoridation studies where examinations are carried out with mirror and explorer. Reported DMF means were somewhat

**Table 1. Oral status of 4,737 children in Montgomery and Prince Georges Counties, Md., 1952**

Mean age (years)	Number of children	Mean number of permanent teeth		Mean number of deciduous teeth		Percent of caries-free children	
		In eruption	DMF <sup>1</sup>	Present	def <sup>2</sup>	Permanent dentition	Deciduous dentition
5.44-----	186	1.08	0.03	19.19	2.15	97.3	47.3
6.47-----	416	5.34	.30	16.22	3.16	86.1	33.7
7.45-----	487	9.14	.96	13.30	3.50	56.7	28.1
8.49-----	475	11.73	1.74	11.17	3.56	36.2	21.1
9.48-----	499	14.21	2.46	8.80	3.45	22.6	20.6
10.47-----	394	17.99	2.94	5.58	2.35	19.0	34.0
11.51-----	420	22.26	4.01	2.74	1.27	11.7	54.8
12.53-----	601	25.45	4.88	1.05	.52	9.0	75.7
13.50-----	572	27.09	6.29	.35	.19	7.2	89.0
14.49-----	513	27.53	7.86	.14	.05	3.9	95.9
15.37-----	174	27.67	8.63	.02	.02	4.0	98.3
All children—10.64---	4,737	18.09	3.71	6.49	1.84	28.4	54.0

<sup>1</sup> Decayed, missing, or filled.

<sup>2</sup> Decayed, extraction indicated, or filled.

**Table 2. Oral status of 1,950 continuous-residence children in Montgomery and Prince Georges Counties, Md., who, on initial examination in 1952, had not had topical fluoride or other caries-preventive treatments**

Mean age (years)	Number of children	Mean number of permanent teeth		Mean number of deciduous teeth		Percent of caries-free children	
		In eruption	DMF <sup>1</sup>	Present	def <sup>2</sup>	Permanent dentition	Deciduous dentition
5.44-----	60	1.40	0.03	19.10	2.77	98.3	36.7
6.46-----	171	5.63	.41	16.04	3.67	81.3	26.9
7.45-----	211	9.22	1.09	13.29	4.04	50.7	22.3
8.50-----	181	11.59	1.90	11.27	3.78	32.6	14.9
9.47-----	223	13.97	2.42	9.07	3.43	19.7	18.4
10.47-----	199	18.28	3.09	5.32	2.30	16.6	33.7
11.50-----	191	22.47	4.39	2.59	1.29	12.6	52.4
12.54-----	228	25.48	4.96	1.03	.47	8.3	77.2
13.51-----	233	27.05	6.15	.32	.16	6.9	91.0
14.50-----	188	27.56	7.66	.18	.07	3.7	94.1
15.36-----	65	27.80	8.57	.00	.00	7.7	100.0
All children—10.60---	1,950	18.07	3.69	6.49	2.03	26.3	50.3

<sup>1</sup> Decayed, missing, or filled.

<sup>2</sup> Decayed, extraction indicated, or filled.

higher after 1 year of fluoridation at Grand Rapids and Brantford (8, 10). The effect is specifically graphed, for first molars, in the third-year report from the Newburgh-Kingston study (12).

**Table 3. Mean numbers of decayed, missing, or filled permanent teeth reported for 14,936 white children in Montgomery and Prince Georges Counties, 1952<sup>1</sup>**

Age last birthday	Number of children examined	Mean number of DMF <sup>2</sup> teeth
5.....	409	0.04
6.....	1,360	.34
7.....	1,389	1.08
8.....	1,428	1.78
9.....	1,333	2.44
10.....	1,167	3.19
11.....	1,059	3.79
12.....	1,260	5.10
13.....	1,145	6.36
14.....	1,150	7.80
15.....	1,238	8.83
16.....	1,057	10.68
17.....	811	11.68
18.....	117	10.68
19.....	12	15.33
20.....	1	7.00

<sup>1</sup> From unpublished data reported by Southern Maryland District Dental Society to Public Health Service Region III (Washington, D. C.).

<sup>2</sup> Decayed, missing, or filled.

Lesions detected for the first time by mirror and explorer, after 1 year of fluoridation, are mostly lesions which began before fluoridation was instituted. By the end of the second year, however, it may be assumed that the majority of lesions detected for the first time by the explorer had their inception after fluoridation began. In the present study population, the second postfluoridation examination shows a drop in total numbers of decayed, filled, or missing permanent teeth, a drop averaging 0.27 teeth per child. Mean numbers of deciduous teeth which are decayed, filled, or indicated for extraction (def) are unchanged or slightly higher.

Mean caries data for the baseline children examined in 1952 and for comparable children examined in 1954 after 2 years of fluoridation are illustrated in the accompanying chart.

#### Increments of New DMF Teeth

Expectancy increments of newly decayed, missing, or filled permanent teeth over a period of 1 year were computed for each age group, by the method used in the Hagerstown studies (13), from findings for the 1952 baseline group. Baseline children aged 7 years, for example, had an average of 1.090 decayed, missing, or filled permanent teeth. Six-year-old children

**Table 4. Summary of findings for continuous-residence children in Montgomery and Prince Georges Counties, Md., who used city water, had not received topical fluoride or other caries-preventive treatments, and were examined in 1952, 1953, and 1954**

Age last birthday	Number of children examined			Mean number of DMF <sup>1</sup> teeth				Mean number of def <sup>2</sup> teeth			
	1952	1953	1954	1952	1953	1954	Difference, 1952 and 1954	1952	1953	1954	Difference, 1952 and 1954
5.....	60	67	94	0.03	0.02	0.01	-0.02	2.77	2.06	2.49	-0.28
6.....	171	238	306	.41	.32	.22	-.19	3.67	4.05	4.07	+.40
7.....	211	175	268	1.09	1.01	.80	-.29	4.04	3.95	4.19	+.15
8.....	181	192	189	1.90	1.63	1.37	-.53	3.78	3.93	3.91	+.13
9.....	223	175	192	2.42	2.43	2.08	-.34	3.43	3.36	3.52	+.09
10.....	199	210	190	3.09	3.01	2.86	-.23	2.30	2.41	2.33	+.03
11.....	191	181	204	4.39	3.82	4.11	-.28	1.29	1.11	1.25	-.04
12.....	228	245	279	4.96	5.13	4.70	-.26	.47	.68	.44	-.07
13.....	233	252	284	6.15	6.65	5.99	-.16	.16	.23	.23	+.05
14.....	188	287	249	7.66	8.35	7.43	-.23	.07	.07	.12	+.03
15.....	65	119	116	8.57	9.62	7.92	-.65	.00	.04	.03	+.03
All children.....	1,950	2,141	2,371	3.69	4.11	3.42	-.27	2.03	1.91	2.08	+.05

<sup>1</sup> Decayed, missing, or filled.

<sup>2</sup> Decayed, extraction indicated, or filled.

had an average of 0.409 decayed, missing, or filled permanent teeth. The difference between these two findings, 0.681 teeth, was accepted as the expected average increase in carious permanent teeth as a group of children goes from the age of about 6½ to about 7½ years. Similar computations yielded the array of expected yearly caries increments shown in table 5.

Among comparable children examined in 1954, there were 1,218 aged 6 through 15 years who had also been examined in 1953. By matching 1953 and 1954 examination records for each of these children, actual numbers of newly carious permanent teeth were determined and analyzed as mean changes over the 12-month period. This method permitted the computation of standard error for each mean change and estimation of the probability that any observed increment varied only by chance from the absolute expectancies computed from the 1952 data. These analyses are also summarized in table 5.

If the presumptive 1952 increment rates had obtained throughout the year 1953-54, 1,130 newly carious permanent teeth would have developed in the group, or an average of 0.928 tooth per child. The actual increment was 910 newly carious permanent teeth, or an average

of 0.747 per child—a difference of 19.5 percent. It is highly improbable that this difference of almost 20 percent is due to chance variation.

About the same result is obtained if expectancy increments are based upon the independent examination conducted by the Southern Maryland District Dental Society. From their data, 1,146 newly carious permanent teeth would have been predicted for the study children during the 1953-54 school year, a difference of 20.6 percent.

## Discussion

Comparisons of observed increments with expected increments, as computed from the 1952 baseline data, should be interpreted with caution. Each of the age groups in the 1952 data is an independent group, subject to biological variation. In the baseline array, DMF totals for children aged 11 years seem rather high. If this be true, the expected increment is an overestimate of DMF incidence between ages 10 and 11 and an underestimate of DMF incidence between ages 11 and 12. This factor of variation is present to a greater or lesser degree throughout the array. Little reliance, then, should be placed on the comparison of expected

**Table 5. Increments of new decayed, missing, or filled permanent teeth over 12 months, from 1953 to 1954, in continuous residents of Montgomery and Prince Georges Counties, Md., who were examined in both years, used city water, and had not received topical fluoride or other caries-preventive treatments, as compared with increments computed from data for comparable children of the same counties in 1952**

Expected mean DMF <sup>1</sup> increment, past year	Children examined in 1953 and again in 1954				
	Mean age, 1954	Number ex- amined	Actual mean DMF <sup>1</sup> incre- ment, 1953-54	Difference be- tween actual and expected increments	Probability differ- ence due to chance <sup>2</sup>
0.376.....	6. 63	27	0. 111 ± 0. 082	-0. 265	< 0. 001
0.681.....	7. 51	160	. 425 ± . 070	- . 256	< . 001
0.811.....	8. 45	121	. 736 ± . 102	- . 075	. 23
0.516.....	9. 47	137	. 489 ± . 097	- . 027	. 39
0.668.....	10. 51	120	. 758 ± . 120	+ . 090	. 23
1.302.....	11. 45	133	1. 075 ± . 132	- . 227	. 04
0.569.....	12. 47	106	. 840 ± . 156	+ . 271	. 04
1.194.....	13. 53	175	1. 006 ± . 151	- . 188	. 11
1.510.....	14. 49	171	. 947 ± . 176	- . 563	< . 001
0.909.....	15. 39	68	. 324 ± . 267	- . 585	. 01
0.928.....		1, 218	. 747 ± . 046	- . 181	< . 001

<sup>1</sup> Decayed, missing, or filled.

<sup>2</sup> Based on areas under the normal curve.

with observed increment in any specific age group. The study plan intends that age-specific incidence data shall ultimately be shown as trends, valid in themselves, with expectancy values serving only as points of departure.

On the other hand, age-specific error tends to be random, and overestimation at one age tends to cancel out underestimation at another if the entire group is considered as a unit. This is well illustrated by the close agreement between expectancy data calculated from the two independent examinations cited. No matter which one of these expectancy curves is used, the same conclusions are reached: that about 20 percent fewer permanent teeth became carious in the whole group than would have been expected on the basis of the 1952 examination and that it is highly improbable the difference is due to chance.

This particular method is not appropriate at all when applied to deciduous teeth without any means of determining whether a missing deciduous tooth has been lost prematurely or normally. On the basis of the cumulative totals shown in table 4, no change in the prevalence of caries in deciduous teeth is apparent in these study groups. Deciduous teeth in these children had been in eruption and at risk of caries for 3 years or more at the time the water supply was fluoridated.

## Summary

This preliminary report has described the examination criteria for dental caries and methods in use and has defined the population under observation in a continuing study of oral health in elementary and junior high school children of Montgomery and Prince Georges Counties, Md. The two counties are adjacent to the District of Columbia. The domestic water used by these children was fluoridated with sodium fluosilicate late in December of 1951. Evidence is presented that there was a statistically valid decrease of roughly 20 percent in the number of permanent teeth becoming carious during the second year of fluoridation, judged by findings from the baseline examination early in 1952.

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# Tuberculin Sensitivity of Young Adults in the United States

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THE rapid and continued decline in tuberculosis mortality during the last decades is changing the approach to tuberculosis control. Interest in the mass X-ray survey for detecting persons with active tuberculosis is being supplemented by interest in the tuberculin test for identifying persons who have been infected by the tubercle bacillus. Large-scale use of the tuberculin test may well receive increasing emphasis for tuberculosis control programs during the coming years.

Interest in tuberculin testing programs is not new. One of the purposes of the Tuberculosis Committee of the American Student Health Association, founded in 1931, was to collect in-

formation on the prevalence of tuberculin sensitivity among college students throughout the Nation (1). And during the 1930's a number of reports were published by Long and associates (2-4), as well as by others (5, 6), on the results of tuberculin testing of college students. A standardized tuberculin product (PPD) became available during the later part of the period, and attention was also directed toward the adoption of a uniform testing technique. The reports, in general, indicated a relatively high frequency of tuberculin reactors in the west, lower frequencies in the central part of the country, and high frequencies in the east. Usually, two doses of PPD were used: a first test with 0.00002 mg. and, for nonreactors to that dose, a second test with 0.005 mg. But results were not reported separately for each dose.

By the early 1940's evidence had accumulated from various studies, particularly from the work of Furcolow and associates (7), that the so-called intermediate dose test with 0.0001 mg. of standardized PPD was sufficient to detect almost all persons with active tuberculous disease or other signs of tuberculous infection. Results of subsequent studies in this country and abroad (8-12) confirmed the earlier findings with the intermediate dose test and, in addition, indicated that most of the sensitivity brought out only by larger doses of tuberculin is not related to tuberculous infection or disease. Such low-grade sensitivity shows pronounced variation with geographic area, being almost

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absent in some localities and highly prevalent in others. It may therefore be assumed that low-grade (nonspecific) sensitivity has inflated the frequency of positive reactors reported from studies in which either 1 mg. of O.T. or 0.005 mg. of PPD has been used as the final dose. The intermediate (0.0001 mg.) dose gradually became more widely accepted, and in 1950 it was recommended by the National Tuberculosis Association for a single-dose testing procedure (13). The intermediate dose was adopted also by the World Health Organization for tuberculin testing in its international tuberculosis and BCG programs (14).

Testing with the intermediate dose of standardized PPD-S, Palmer and associates (8, 9) found an average frequency of about 12 percent reactors among more than 20,000 young white women entering schools of nursing in various parts of the country between the years 1943 and 1949. The frequencies ranged from less than 10 percent in residents of some of the midwestern States to around 17 percent in girls from the east coast and more than 20 percent in Oklahoma, Texas, and Indiana. Canada and Babione (15), using the same dose of tuberculin for testing nearly 80,000 Navy recruits and midshipmen in 1948, reported an average frequency of 9.7 percent positive reactors. Although their results were not given by geographic area of residence, the frequency of reactors was significantly higher in the men at the Naval Training Center at San Diego, Calif., than in those at the Naval Training Center at Great Lakes, Ill.

This paper presents the results and discusses the implications of a tuberculin testing program conducted in 1949-51 among more than 120,000 young white adults—Navy recruits and college students—from almost all parts of the United States.

The study, like most public health research projects, represents the cooperative efforts of many persons and groups. In addition to thousands of young men and women who participated as subjects of study, we had the assistance of the medical corpsmen and officers of the U. S. Naval Training Center, San Diego, and Captains Sidney A. Britten and Charles A. Castle of the Tuberculosis Control Section, Preventive Medicine Division, Bureau

of Medicine and Surgery, Department of the Navy. Also cooperating were the directors of student health and their staffs at Berea College, Fort Hays Kansas State College, Iowa State College, Kansas State College, Miami (Ohio) University, Ohio State University, Oklahoma A. and M. College, Purdue University, South Dakota State College, St. Joseph's College and Military Academy, Syracuse University, the universities of Chicago, Colorado, Indiana, Kansas, Kentucky, Minnesota, Missouri, Pennsylvania, and Wisconsin, and various professional schools in New England.

### Material and Methods

The major part of the study is based on the results of tuberculin testing of 83,599 white men, 17-21 years of age, as they entered the Naval Training Center at San Diego, Calif., during the years 1949-51. In cooperation with the U. S. Navy, arrangements were made systematically to test each new recruit with tuberculin, histoplasmin (16), and coccidioidin and also to obtain a complete residence history. Serious efforts were made to see that no new recruit was missed. The testing was done by a small group of medical corpsmen who were carefully instructed and periodically supervised by Public Health Service research personnel. While some turnover of corpsmen was unavoidable, one principal corpsman was in charge during most of the study period.

In addition, 38,070 white students (22,684 men and 15,386 women) 17-21 years of age were tested during the years 1949-50 in some 35 colleges and universities in 17 States, largely in the middle west. Most of the students were freshmen. The testing was done by a physician or nurse at each college although at the beginning of the program a member of the research staff of the Public Health Service was present to help standardize the testing procedures.

The entire study population, recruits as well as college students, were tested by intradermal injection of 0.1 ml. containing 0.0001 mg. of PPD-S (5 tuberculin units of the international standard PPD). Reactions were read at 48-72 hours by measuring the transverse diameter of induration in millimeters. In this report, a

reaction with an induration recorded as measuring 5 mm. or more has been designated as positive.

Residence histories were obtained by a questionnaire in which each Navy recruit and college student specified, in chronological order, each locality where he had lived since birth. Those who had spent their whole life in one State, without residing elsewhere for periods longer than 6 months, were later classified as "one-state residents." Of the Navy recruits, 56,481 could be classified as one-state residents. Of the college students, 15,148 of the men and 11,250 of the women could be so classified.

One-state residents who had never spent more than 6 months away from one section of their home State were further classified as "one-section residents."

A section consisted of a number of counties with rough adjustment in size for differences in population density. Sections were small in densely populated areas, larger in areas of low population density. A total of 49,404 recruits were one-section residents.

The questionnaire also requested information on the basis of which the type of residence was classified into four groups. Metropolitan residents were defined as those living in cities of more than 100,000 population (according to the 1940 census) or in the suburbs of these cities. Farm residents were those who lived on farms. All other types of residence were classified under the broad heading of "other." And persons with more than one type of residence were classified as "mixed."

Table 1. Numbers tested and percentage of positive reactors in each group, by age

Age in years at last birthday	Navy recruits		College students				All groups	
			Male		Female			
	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive
17-----	15, 389	8. 9	4, 209	5. 6	3, 532	6. 0	23, 130	7. 9
18-----	21, 588	8. 4	8, 980	7. 2	6, 583	6. 3	37, 151	7. 7
19-----	26, 073	8. 7	3, 937	8. 8	2, 668	7. 4	32, 678	8. 6
20-----	14, 639	10. 4	3, 059	12. 4	1, 712	8. 0	19, 410	10. 5
21-----	5, 910	11. 4	2, 499	14. 1	891	10. 3	9, 300	12. 0
Total-----	83, 599	9. 1	22, 684	8. 6	15, 386	6. 8	121, 669	8. 8
Mean age in years-----	19. 2		19. 1		18. 8		19. 1	

Table 2. Numbers tested and percentage of positive reactors in one-state residents and in residents of more than one State

Residence	Navy recruits		College students			
			Male		Female	
	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive
One-state residents:						
In States with 200 or more tested.....	55,706	8.7	14,445	7.5	9,980	6.6
In States with less than 200 tested.....	775	7.2	703	7.4	1,270	6.8
Residents of more than one State.....	27,118	10.2	7,536	11.0	4,136	7.7
Total.....	83,599	9.1	22,684	8.6	15,386	6.8

Study of geographic differences in the prevalence of tuberculin sensitivity is based primarily on the data from the Navy recruits. The Naval Training Center at San Diego draws recruits from all over the country except the north Atlantic States and the Great Lakes region. And, as all of the men were tested in San Diego with the same tuberculin product and by the same personnel, variations (and errors) in technique would be expected to be distributed at random without regard to previous place of residence. Moreover, though the recruits cannot be re-

garded as representative of the general population of young men of the same age, one could expect those from one locality to be much the same kind of men as those from other localities.

### Results

The numbers tested and the percentage with reactions of 5 mm. or more for all of the recruits and college students are given by age in table 1. The overall frequency of positive reactors is 8.8 percent, ranging from 9.1 in the recruits to

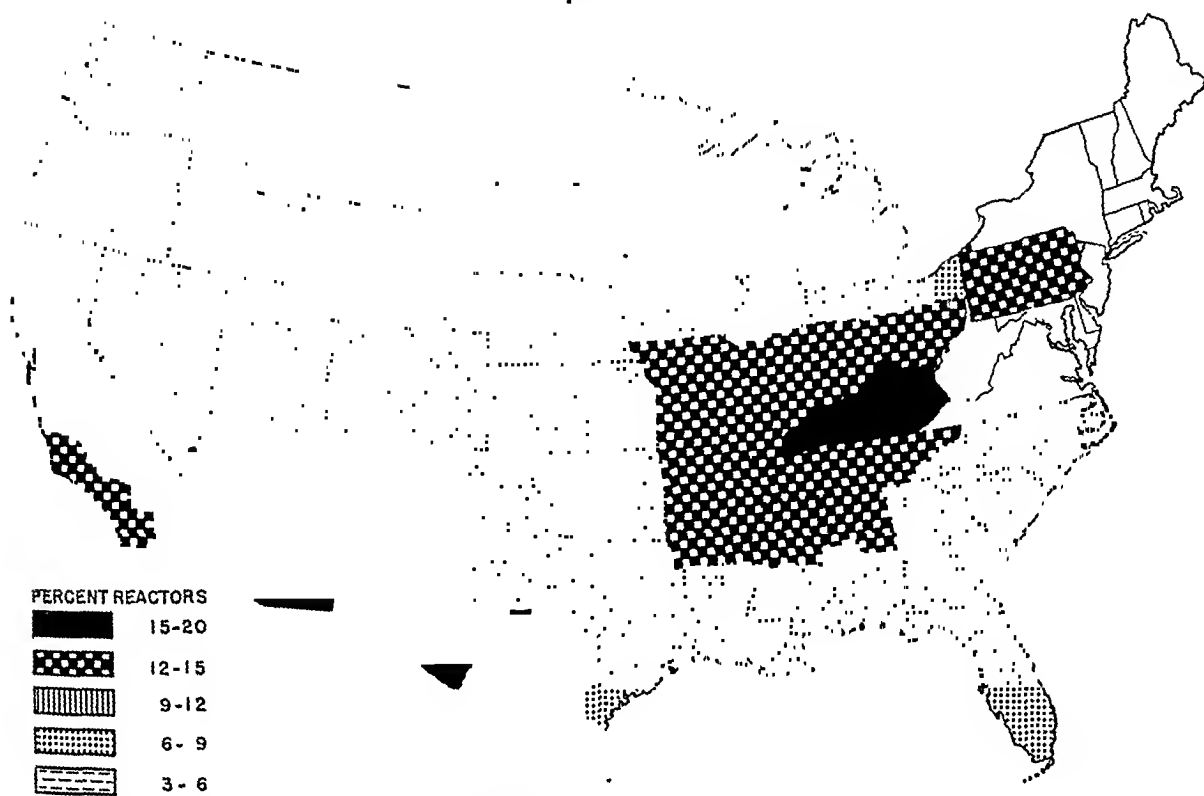
Table 3. Numbers tested and percentage of positive reactors in one-state residents, by State of residence <sup>1</sup>

State	Navy recruits		College students			
			Male		Female	
	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive
Alabama.....	1,981	8.0				
Arizona.....	472	22.7				
Arkansas.....	1,785	8.9				
California.....	8,496	11.6				
Colorado.....	1,444	8.2				
Florida.....	1,469	5.3	308	9.7		
Georgia.....	1,961	7.2				
Idaho.....	708	3.4				
Illinois.....	879	9.7				
Indiana.....	1,125	10.0	1,689	8.5	1,156	9.7
Iowa.....	2,567	4.9	1,478	7.9	831	6.0
Kansas.....	1,900	6.2	640	3.8	318	5.7
Kentucky.....	1,010	16.7	2,577	4.5	1,651	3.6
Louisiana.....	1,533	7.4	534	15.5	374	12.0
Massachusetts.....						
Minnesota.....					433	10.8
Mississippi.....	1,337	7.3			1,255	5.1
Missouri.....	2,336	11.6				
Montana.....	839	5.6	879	9.6	535	8.2
Nebraska.....	1,580	3.9				
New Jersey.....						
New Mexico.....	601	18.0	246	7.3		
New York.....						
North Carolina.....	2,645	6.0	1,333	8.3	779	7.3
Ohio.....	1,341	11.1				
Oklahoma.....	2,170	8.9	2,079	7.8	1,172	5.4
Oregon.....	1,182	6.9	1,035	7.9	837	6.1
Pennsylvania.....	531	10.9				
South Carolina.....	1,308	5.0	362	12.2		
South Dakota.....	401	4.5				
Tennessee.....	1,788	11.3	275	5.5		
Texas.....	6,834	8.7				
Utah.....	976	4.4				
Washington.....	2,180	6.8				
Wisconsin.....			1,010	5.0	639	6.9
Wyoming.....	327	5.5				
Total.....	55,706	8.7	14,445	7.5	9,980	6.6

<sup>1</sup> Excludes States represented by less than 200 persons.



Figure 1. Distribution of States or sections of States by prevalence of positive tuberculin reactors in Navy recruits.



States represented by insufficient data are unshaded.

6.8 in the women students. The frequency increases with age, especially in the college men.

The frequency of reactors in the one-state residents was found to be lower than in those who had lived in more than one State (table 2). The latter group also includes all persons born outside of the United States. Further, in the Navy recruits, the frequency of reactors in the States from which 200 or more were tested was higher than in States represented by smaller numbers, mainly States in the north central section of the country and in New England.

The findings among the one-state residents are given in table 3 for States from which 200 or more persons were tested. Except for Kentucky, New Mexico, and Arizona, the percentage of reactors among the recruits does not exceed 12, and for 9 of the 31 States it is less than 6. The same broad pattern of geographic variation is found for the college students although the

prevalence of tuberculin sensitivity is generally lower than in the recruits.

Based only on one-section residents among the Navy recruits, the area covered by the 31 States has been divided into five different levels of prevalence of tuberculin sensitivity (fig. 1). States and sections of States have been grouped in order to show the broad geographic pattern of variation in prevalence of sensitivity. Sectional subdivisions of States have been maintained only where groups of sections appeared to have distinctly different rates from those of the neighboring sections. (For continuity, Nevada has been included although only 96 recruits were tested from that State.)

The map shows that the frequency of tuberculin reactors is less than 10 percent over most of the country, from the northwestern to the southeastern coasts. Areas of significantly higher frequencies appear in some east central States and in the southwest, but only among residents

of Kentucky, Arizona, New Mexico, and the southern part of Texas do the rates exceed 15 percent.

The frequency of tuberculin reactors varies with type of residence. Table 4 shows it is generally highest in the metropolitan and lowest in

the farm residents. It is, therefore, pertinent to consider to what extent the geographic variations shown in table 3 and figure 1 may be influenced by differences in the relative proportions of different types of residence.

The findings by type of residence for recruits

**Table 4. Numbers tested, percentage distribution, and percentage of positive reactors, by type of residence <sup>1</sup>**

residence <sup>1</sup> Percentage of positive reactors, by type of

Type of residence	Navy recruits			College students						All groups
			Percent positive	Male			Female			
	Tested			Tested		Percent positive	Tested		Percent positive	
	Number	Percent		Number	Percent		Number	Percent		
Metropolitan.....	10, 853	24	10. 1	4, 836	36	8. 5	4, 254	42	7. 2	9. 1
Farm.....	11, 858	26	6. 0	2, 721	20	5. 3	1, 486	15	4. 3	5. 7
Other.....	22, 467	50	9. 3	5, 983	44	8. 0	4, 412	43	6. 9	8. 7
All types.....	45, 178	100	8. 6	13, 540	100	7. 6	10, 152	100	6. 6	8. 1
Adjusted to distribution by type of residence of Navy recruits.....						7. 4			6. 3	

<sup>1</sup> Excludes persons of mixed residence

<sup>1</sup> Excludes persons of mixed residence.

**Table 5. Numbers tested and percentage of positive reactors, by State and by type of residence, <sup>1</sup> for Navy recruits from 20 States**

States arranged by decreasing frequency of positive reactors	Metropolitan		Farm		Other residence		All types		Adjusted <sup>2</sup> percent positive	States arranged by adjusted frequency of positive reactors
	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive	Number tested	Percent positive		
1 Kentucky.....	217	13. 8	304	14. 8	320	16. 6	841	15. 2	15. 4	1
2 Missouri.....	746	12. 5	490	6. 1	665	14. 7	1, 901	11. 6	12. 0	2
3 California.....	3, 666	10. 9	712	10. 0	2, 648	11. 8	7, 026	11. 1	11. 1	4
4 Tennessee.....	417	10. 8	562	9. 6	477	12. 6	1, 456	10. 9	11. 4	3
5 Indiana.....	229	9. 6	170	8. 8	531	11. 5	930	10. 5	10. 3	5
6 Ohio.....	524	10. 5	147	8. 8	469	10. 9	1, 140	10. 4	10. 3	6
7 Illinois.....	224	7. 1	162	7. 4	355	13. 5	741	10. 3	10. 2	7
8 Texas.....	1, 006	11. 1	1, 100	4. 6	2, 900	10. 3	5, 006	9. 2	9. 2	8
9 Oklahoma.....	287	7. 3	566	8. 0	850	9. 9	1, 703	8. 8	8. 7	9
10 Colorado.....	342	7. 6	250	4. 8	549	10. 7	1, 141	8. 5	8. 4	11
11 Alabama.....	202	7. 9	556	5. 9	801	9. 7	1, 559	8. 1	8. 3	12
12 Louisiana.....	225	14. 2	337	6. 2	665	6. 3	1, 227	7. 7	8. 6	10
13 Oregon.....	219	5. 5	245	3. 7	426	10. 6	890	7. 4	7. 5	13
14 Georgia.....	201	9. 5	493	4. 5	800	7. 8	1, 494	6. 9	7. 5	14
15 Washington.....	641	8. 4	389	6. 4	669	5. 4	1, 699	6. 8	6. 5	16
16 Kansas.....	160	11. 2	485	3. 3	852	6. 9	1, 497	6. 2	7. 3	15
17 Florida.....	302	7. 9	186	3. 8	739	4. 2	1, 227	5. 1	5. 2	18
18 Iowa.....	205	7. 3	701	2. 6	1, 163	5. 9	2, 069	4. 9	5. 5	17
19 Utah.....	261	7. 7	205	. 5	308	4. 2	774	4. 4	4. 3	20
20 Nebraska.....	214	7. 9	454	2. 6	623	3. 4	1, 291	3. 9	4. 5	19
Total.....	10, 288	10. 2	8, 514	6. 0	16, 810	9. 4	35, 612	8. 8	8. 9	

<sup>1</sup> Excludes persons of mixed residence.

<sup>2</sup> Adjusted to distribution by type of residence of the total.

from the 20 States in which metropolitan, farm, and other residents were each represented by reasonably large numbers are given in table 5. Relative frequencies of reactors for the three types of residence vary considerably from one State to another. However, as shown by the last column in the table, adjustment for the differences in distribution by type of residence has only a limited effect on the order of the 20 States as arranged by frequency of tuberculin reactors. It must be assumed, nevertheless, that type of residence is of greater importance for total frequency of reactors in other States where metropolitan areas, as defined, do not exist, or where the distribution by type of residence is for other reasons less uniform.

The frequency of tuberculin reactors in the

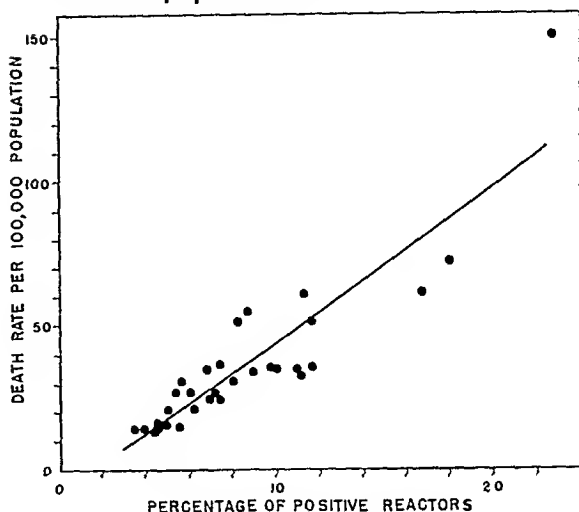
**Table 6. Percentage of positive reactors in Navy recruits (one-state residents<sup>1</sup>) and average annual tuberculosis death rates per 100,000 white population, by State, 1939-41**

State	Percent positive	Tuberculosis death rate <sup>2</sup>
Alabama.....	8.0	32
Arizona.....	22.7	150
Arkansas.....	8.9	34
California.....	11.6	51
Colorado.....	8.2	51
Florida.....	5.3	27
Georgia.....	7.2	26
Idaho.....	3.4	14
Illinois.....	9.7	36
Indiana.....	10.0	35
Iowa.....	4.9	16
Kansas.....	6.2	21
Kentucky.....	16.7	62
Louisiana.....	7.4	37
Mississippi.....	7.3	25
Missouri.....	11.6	36
Montana.....	5.6	32
Nebraska.....	3.9	14
New Mexico.....	18.0	72
North Carolina.....	6.0	27
Ohio.....	11.1	33
Oklahoma.....	8.9	34
Oregon.....	6.9	25
Pennsylvania.....	10.9	35
South Carolina.....	5.0	21
South Dakota.....	4.5	15
Tennessee.....	11.3	61
Texas.....	8.7	55
Utah.....	4.4	14
Washington.....	6.8	35
Wyoming.....	5.5	15

<sup>1</sup> Excludes States represented by less than 200 persons.

<sup>2</sup> Computed from mortality and population figures given in Vital Statistics of the United States, 1939-41.

**Figure 2. Correlation for 31 States between percentage of positive tuberculin reactors in Navy recruits and average annual death rates from tuberculosis (all forms) for 1939-41 in the white population.**



total study population, as well as in the population used for studying geographic variations, is highest in the recruits, lower in the college men, and lowest in the college women. The differences are statistically significant. They cannot be accounted for by differences in age distribution since that was essentially the same in each group. Nor can they be ascribed to the unequal geographic distribution of the groups.

As shown in table 3, for the 8 States from which more than 200 persons (all one-state residents) were tested within each of the three groups, the prevalence of reactors ranges from relatively high (Kentucky) to low (Iowa). Correction for the inequality in geographic distribution of the recruits and the college students does not reduce the differences in the total prevalence of reactors in those 8 States. The proportion of metropolitan residents is lowest in the recruits, higher in the college men, and highest in the college women (table 4). Consequently, an adjustment of the college student rates to the distribution, by type of residence, of the recruits tends to increase rather than decrease the differences between the groups.

Differences between recruits and college men with respect to tuberculin sensitivity are not found in those who had been residents of more than one State, nor in the one-state residents from States represented by small numbers

**Table 7. Frequency distributions of sizes of reactions among**  
Transverse diameter of induration (in millimeters)

State of residence <sup>1</sup>	Number tested <sup>2</sup>	00	01	02	03	04	05	06	07	08	09	10	11	12
Alabama.....	1,981	1,795	---	17	7	4	21	12	4	13	6	19	6	7
Arizona.....	472	355	---	4	3	3	6	5	3	7	7	14	1	14
Arkansas.....	1,785	1,599	---	14	8	5	8	5	8	14	5	22	9	10
California.....	8,496	7,438	---	46	15	14	30	21	30	42	34	101	36	73
Colorado.....	1,444	1,320	---	5	1	---	3	2	4	5	---	12	10	3
Florida.....	1,469	1,364	---	10	14	3	9	4	4	10	3	17	3	6
Georgia.....	1,961	1,788	1	14	13	4	17	4	6	10	10	27	5	10
Idaho.....	708	679	---	4	---	1	1	---	1	---	---	1	3	3
Illinois.....	879	788	---	3	1	2	4	2	3	4	2	5	5	6
Indiana.....	1,125	1,005	---	5	1	1	4	1	5	2	2	15	2	13
Iowa.....	2,567	2,421	---	8	7	5	7	---	6	8	6	12	8	5
Kansas.....	1,900	1,771	---	8	2	2	8	6	5	4	4	18	4	7
Kentucky.....	1,010	832	---	2	2	5	4	6	4	19	6	23	5	17
Louisiana.....	1,533	1,390	---	12	9	8	11	9	14	15	10	7	6	10
Mississippi.....	1,337	1,213	---	14	9	3	7	10	8	8	5	21	4	8
Missouri.....	2,336	2,027	---	16	12	9	20	10	11	20	6	41	9	20
Montana.....	839	788	---	---	3	1	---	3	1	1	---	3	3	1
Nebraska.....	1,580	1,499	---	9	5	5	2	5	3	3	2	4	1	5
New Mexico.....	601	487	---	2	1	3	4	1	2	5	3	17	5	6
North Carolina.....	2,645	2,453	1	15	8	10	11	8	7	13	8	21	5	7
Ohio.....	1,341	1,186	---	---	4	2	12	4	6	4	6	22	6	12
Oklahoma.....	2,170	1,939	---	21	7	9	9	---	10	10	8	28	14	14
Oregon.....	1,182	1,087	---	10	3	1	---	---	1	4	1	7	3	1
Pennsylvania.....	531	466	---	7	---	---	---	1	3	6	---	12	3	2
South Carolina.....	1,308	1,222	---	14	4	3	7	2	4	8	3	9	4	5
South Dakota.....	401	381	---	2	---	---	1	---	2	---	---	2	---	2
Tennessee.....	1,788	1,573	---	4	1	8	8	7	10	14	7	21	9	17
Texas.....	6,834	6,130	---	53	28	29	40	26	44	51	31	78	28	45
Utah.....	976	925	---	3	3	2	1	2	1	---	2	6	3	4
Washington.....	2,180	2,014	---	11	5	1	3	4	2	3	5	13	4	8
Wyoming.....	327	305	---	3	1	---	---	---	---	1	---	6	1	1
Total.....	55,706	50,240	2	336	177	143	258	169	212	304	182	604	205	342

<sup>1</sup> Excludes States represented by less than 200 persons. <sup>2</sup> Includes only persons classified as one-state residents.

(table 2). Nor is the relative frequency of reactors in college women consistently the lowest in all States represented in the study (table 3).

#### *Tuberculin Sensitivity and Tuberculosis Deaths*

The prevalence of positive reactors in each of the 31 States from which 200 or more recruits were tested was related to the average annual tuberculosis death rates in the white population, by State, for the 3-year period 1939-41, the midpoint in the lives of the 17- to 21-year-old recruits (table 6 and fig. 2). A high positive correlation was found, the coefficient of correlation being 0.88. That finding led to an examination of the relation between the prevalence of positive reactors and other tuberculosis death rates: sex-specific rates for the period 1939-41 and average annual rates for 1929-31 and for 1949-51, as well as the mean annual death rates for all three periods (1929-31, 1939-41, 1949-51). Coefficients of correlation range from

0.84 to 0.93. The difference is not statistically significant.

#### *Variation in Size of Tuberculin Reactions*

Results thus far have been presented in terms of the conventional definition of a positive reaction as one measuring 5 mm. or more. The use of that definition, according to recent studies in many countries (10), may mean that reactions of quite different significance are being classed as positive in different geographic areas. Distributions of the sizes of the reactions were therefore studied, and the basic data are given in table 7.

While the data are inadequate for detailed analysis by single States, pooled results from several States illustrate the difference that may be found between two geographic areas (fig. 3). The figure shows percentage distributions, by size, for reactions measuring 2 mm. or more, for recruits from four northwestern States,

# Navy recruits to the intradermal 0.0001 mg. tuberculin test

Transverse diameter of induration (in millimeters)

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28+	State of residence <sup>1</sup>
4	5	22	2	6	3	2	16	5	5	1	1	1	1	2	Alabama.	
3	2	7	1	4	7	3	5	2	6	2	2	3	2	1	Arizona.	
7	6	16	8	5	6	1	11	3	3	1	2	6	1	2	Arkansas.	
29	64	109	43	33	58	19	84	11	34	16	18	34	4	6	54	California.
2	3	13	6	5	7	3	13	3	3	2	1	9	1	1	8	Colorado.
3	4	6	1	1	1	1	2	1	3	1	1	3	1	1	1	Florida.
4	5	10	1	6	2	3	8	3	4	1	2	2	1	1	6	Georgia.
1	1	1	1	2	1	1	3	3	3	1	1	1	1	1	1	Idaho.
4	4	9	5	4	4	2	8	1	1	3	7	7	1	1	1	Illinois.
3	7	11	5	4	7	2	10	1	8	2	1	2	2	1	5	Indiana.
4	9	9	6	9	2	2	8	3	3	3	3	5	3	3	5	Iowa.
4	2	11	6	5	3	1	7	3	5	3	1	6	1	1	4	Kansas.
5	8	20	5	5	6	1	14	1	4	3	1	7	1	1	6	Kentucky.
3	7	6	1	6	1	6	6	1	1	1	1	1	1	1	2	Louisiana.
1	3	11	3	1	1	1	5	1	1	1	1	1	1	1	1	Mississippi.
9	14	24	6	6	15	2	26	2	5	3	3	9	1	1	11	Missouri.
2	7	2	2	2	2	1	6	1	3	1	1	3	1	1	3	Montana.
1	3	8	4	1	3	1	11	1	1	1	1	1	1	1	3	Nebraska.
1	5	10	2	5	8	1	13	1	3	1	1	8	1	1	5	New Mexico.
2	8	14	1	4	4	3	17	3	3	3	5	2	2	2	9	North Carolina.
7	8	16	3	7	8	1	10	1	1	1	2	1	2	2	7	Ohio.
2	11	17	5	3	6	5	22	2	3	2	4	3	1	1	6	Oklahoma.
5	8	7	4	3	5	1	11	2	3	1	2	2	1	1	6	Oregon.
1	2	9	1	1	1	1	8	4	4	1	4	4	1	1	2	Pennsylvania.
1	1	5	2	2	3	1	3	1	1	1	2	2	1	1	2	South Carolina.
1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1	South Dakota.
5	8	22	8	8	10	4	16	1	6	1	1	10	1	1	9	Tennessee.
17	22	58	15	18	23	9	33	6	14	5	9	10	2	1	10	Texas.
2	4	5	2	2	1	1	4	1	1	1	1	1	1	1	1	Utah.
2	10	18	5	5	10	5	20	2	11	2	4	2	2	2	9	Washington.
1	1	3	1	1	1	1	2	1	1	1	1	1	1	1	1	Wyoming.
133	242	480	152	152	220	75	403	48	140	58	55	149	23	22	180	Total.

Idaho, Montana, Oregon, and Washington, and from four southeastern States, Alabama, Georgia, Louisiana, and Mississippi.

The concentration of reactions on "round" numbers (5, 10, 15, and 20 mm.) is obvious and indicates inaccuracy of reading even though serious efforts had been made to obtain precise measurements. (It may be recalled in this connection that each observer tested recruits from all over the country, and thus his inaccuracy would not be expected to bias the measurement of reactions of men from different geographic areas.) A smoothed curve is superimposed on each distribution to bring out the striking contrast between their shapes. While the distribution of reactions for the northwestern States is bimodal with a minimum at about 5 mm., that representing the southeastern group of States is unimodal with a relative concentration of readings in the 2 to 10 mm. range.

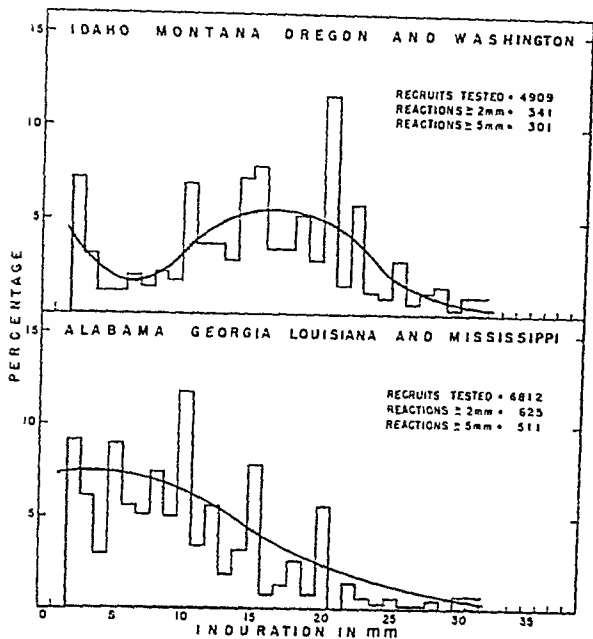
Among reactions commonly classed as positive, those measuring 5 mm. or more, the results

obtained in the two geographic areas may be compared numerically by expressing the frequency of reactions measuring 5-9 mm. as a percentage of all reactions measuring 5 mm. or more. In the four northwestern States, only 10 percent of the positive reactions are less than 10 mm. in diameter; in the four southeastern States, 40 percent are less than 10 mm. Although the two groups of States represented in figure 3 were selected to show the greatest difference in the relative frequencies of small reactions, the data in table 7 indicate that the proportion of small reactions varies considerably from one geographic area to another.

## Discussion

The findings of the present study confirm a number of recent reports that the frequency of tuberculin reactors among young white adults from over a large part of the United States is, today, very low—less than 10 percent at about

**Figure 3.** Percentage distributions of reactions measuring 2 mm. or more to the intradermal 0.0001 mg. tuberculin test in Navy recruits from four northwestern and four southeastern States.



20 years of age. In a few areas the frequency may be twice as high; but in many, and particularly in the rural parts of the country, it is below 5 percent.

In interpreting these findings it is important to appreciate that the frequency of reactors at 20 years of age represents the result of tuberculous infections that have occurred during the previous two decades. On the assumption that reversion of tuberculin sensitivity is rare, an average prevalence of less than 10 percent corresponds to an average infection rate of about 5 per 1,000 per year. A prevalence of around 5 percent found in many parts of the country implies a still lower infection rate, an average of around 2 per 1,000 per year. There is every reason to believe, however, that the risk of infection has not been constant but has declined during recent years. (Deaths from tuberculosis for the 0- to 19-year-old white population have dropped from 8.2 per 100,000 in 1939-41 to 0.7 in 1954.) At present, the annual rate of tuberculous infection in white children and adolescents over a large part of the country may well be less than 1 per 1,000 per year. Under

such circumstances, most of our children can now be expected to reach adulthood without having acquired a tuberculous infection (19).

Type of residence has been shown by many workers to have considerable influence on the prevalence of tuberculin sensitivity, and our findings are in accord. The frequency of reactors is generally higher in urban than in rural residents. Had metropolitan residents in this study been defined as persons living strictly within city limits, the difference in rates between metropolitan and other residents might have been even greater.

Significant differences are shown in the percentage of reactors among the Navy recruits and the college students, differences that cannot be accounted for by age or by type of residence. They undoubtedly reflect the various factors, including socioeconomic status, that govern whether young men join the Navy or go to college. Among the college students, a higher frequency of reactors among men than women agrees with results of earlier investigations (4, 5). It is not inconceivable that women students on the whole generally come from a higher social stratum than men. The fact that the frequency of reactors is usually about the same among boys and girls up to high school age (17, 18) points again to some form of selection as accounting for the differences between sex-specific rates in college students.

Age, sex, race, and, to some extent, type of residence and probably socioeconomic factors do not, however, account for the broad geographic variations in the frequency of tuberculin reactors among Navy recruits (fig. 1). The variations must be ascribed to other factors, some of which are known to be of influence and some whose influence is entirely unknown. To the former belong ethnic differences and the well-known tendency of tuberculosis patients to move to certain areas, particularly the southwestern part of the country. Factors like those may, to a large extent, account for the high prevalence of reactors in California, Arizona, New Mexico, and part of Texas. Of particular interest is the relatively high percentage of reactors in some of the east central States, where such factors are presumably of less importance.

The high correlation between tuberculosis

death rates and percentage of tuberculin reactors, by States, represents one of the critical results of the present study and must mean that both the frequency of low-dose reactors and the tuberculosis death rates reflect the same general features of tuberculosis in a community.

Recent years have seen a growing interest in large-scale tuberculin testing surveys. In communities where tuberculosis mortality rates are not adequate or not available, results of tuberculin testing may well be the best yardstick of the tuberculosis problem. For pinpointing localities and special situations where infection rates are still high and where energetic control measures could with profit be instituted or strengthened, the test is of unchallenged value. Where, on the other hand, the prevalence rates are low, the use of the tuberculin test as an index of time changes in the tuberculosis problem has distinct limitations. To obtain stable and representative rates would require the testing of very large groups; to estimate conversion rates or to identify an appreciable number of converters would require the retesting of literally tens of thousands of persons.

A number of studies in this country and elsewhere have shown that a high proportion of new cases of tuberculosis—in some areas most of the new cases—come from among the positive tuberculin reactors (20-25). Moreover, the risk of developing clinical disease is apparently much greater for those who have large reactions than for those who have small reactions to a low-dose tuberculin test (23, 25). Perhaps one of the most tangible benefits to be derived from tuberculin testing programs is therefore the identification of the infected persons in the community and, by careful measurement of the reactions, the selection of those most at risk of developing tuberculosis. Careful followup of that selected group can be expected to facilitate early diagnosis and treatment of active disease. And, looking to the future, research studies now in progress offer reason to hope that the antimicrobial agents already found so effective in the treatment of clinical tuberculosis may also prove effective in preventing the development of disease in persons already infected (26).

How efficient are present-day tuberculin testing procedures for excluding from among the persons being called positive those who have

not been infected with the tubercle bacillus? Material from this study, as illustrated in figure 3, shows considerable geographic difference in the sizes of tuberculin reactions generally considered positive. In the north, most of the positive reactions are large and undoubtedly represent specific infection with virulent tubercle bacilli. But in the south, and to a lesser extent in other areas, many of the reactions are small, measuring from 5 to around 10 or 12 mm. in diameter. Distributions similar to those found in the south have been reported from many countries (10) where high proportions of the population have the low-grade kind of sensitivity referred to as non-specific and where many of the small reactions obtained with a low-dose of tuberculin are believed to be cross reactions representing infection with some organism (probably nonpathogenic) which produces sensitivity to tuberculin.

Many years ago the veterinarians had to face a similar situation with the problem of the "no-lesion reactor"—cattle that reacted to tuberculin yet showed no evidence of tuberculous infection. While the problem is still far from solved, it has long been known that tuberculin sensitivity in cattle may be caused by infection with a variety of micro-organisms, including the avian tubercle bacillus, *Mycobacterium johnei*, and others. The term "nonspecific" is commonly used by veterinarians to denote the tuberculin sensitivity caused by such organisms. Although that term may not be entirely satisfactory, Paterson has recently written that: "Provided the tuberculin is defined—then the reactions it produces may be classified as 'specific' or 'nonspecific.' The reactions produced by mammalian (human or bovine) tuberculin in the subject infected by mammalian tubercle bacilli are specific, by avian tubercle bacilli, non-specific. The reaction of an avian type sensitized individual to avian tuberculin is also a specific reaction, to a mammalian sensitized, nonspecific" (27).

In the tuberculin testing of cattle, the problem of the no-lesion reactor did not become of practical concern until the prevalence of bovine tuberculosis fell to low levels, until the non-specific reactors became a significant proportion of all positive tuberculin reactors. We are now entering the same stage in the tuberculin test-

ing of humans. Our problem is no longer simply to separate persons having tuberculin sensitivity from those having no sensitivity; it includes also the discrimination between specific and nonspecific tuberculin sensitivity. While the separation of the two kinds of sensitivity has been improved by using only a small dose of tuberculin, further improvement cannot be expected by further change in dosage (28, 29). The crux of the matter is that with the tuberculin products at present available the smaller specific reactions do not differ in size from larger nonspecific reactions. We need to develop new techniques for distinguishing the two kinds of sensitivity; perhaps a more specific testing product, perhaps comparative testing techniques along the lines developed by the veterinarians to deal with the analogous problem in cattle.

### Summary

Tuberculin sensitivity was studied during 1949-51 in more than 120,000 white men and women, 17-21 years of age, by testing with the intermediate (0.0001 mg.) dose of the international standard tuberculin PPD-S. The study population comprised Navy recruits from all parts of the country, tested as they entered the Naval Training Center at San Diego, Calif., and students, mostly freshmen, attending colleges and universities in 17 States. Residence histories obtained from each person at the time of the testing provided material for studying geographic differences in the prevalence of tuberculin sensitivity.

The average frequency of reactors was 8.8 percent, corresponding to an average annual infection rate of less than 5 per 1,000 during the last two decades. However, prevalence rates among Navy recruits ranged from about 20 percent in lifetime residents of Arizona and New Mexico to less than 4 percent in Idaho and Nebraska. Rates in the college students, while generally lower, reflected similar geographic differences. Residents of metropolitan areas generally had higher rates than farm residents.

A high positive correlation was found between the frequency of reactors among the

Navy recruits and tuberculosis death rates among the white populations of their home States.

The sizes of tuberculin reactions generally classified as positive showed considerable geographic differences in the relative proportions of small and large reactions. In four western States about 10 percent of the reactions measuring 5 mm. or more were found to be 9 mm. in diameter in contrast to 40 percent in four southeastern States. The relative preponderance of small reactions is ascribed to a low-grade kind of sensitivity not related to tuberculous infection; whereas most of the larger reactions represent specific sensitivity. Careful measurement of reactions is essential for the efficient identification of persons at risk of developing clinical tuberculous disease.

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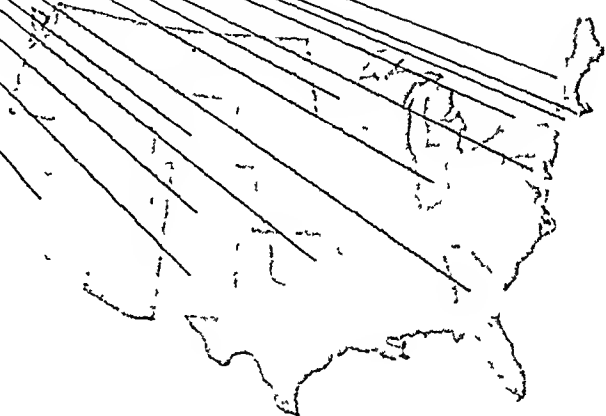


# Proprietary Nursing Homes

## *A Backdrop of Facts* **ON PATIENTS AND THEIR CARE**

By JERRY SOLON, M.A.

a  
study  
of the  
proprietary  
nursing homes  
in thirteen states



**I**NFORMATION about the patients and their care is a sensitive means of learning what type of facility nursing homes really are. Taking this approach, 13 States participated with the Commission on Chronic Illness and the Public Health Service in a study of the character-

istics and care of long-term patients in various types of institutions during 1953-54.

A full report of the study will be issued by *Public Health Reports* as a Public Health Monograph. An earlier report has been published as a reprint from *The Modern Hospital* of May 1955 by the Public Health Service under the title, "Patients in Proprietary Nursing Homes."

A description of the proprietary nursing homes of the 13 States in the study is presented here in a brief chart review.

The States in the survey are California, Colorado, Connecticut, Georgia, Indiana, Maryland, Minnesota, New Mexico, New York, Oklahoma, Rhode Island, Vermont, and Wyoming. In composite, they present a fairly representative picture of nursing home patients in the country.

The term "nursing home" was found to have

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Mr. Solon, who has been serving as a research associate of the Commission on Chronic Illness for a study of long-term patients, is health program analyst with the Division of Hospital and Medical Facilities, Public Health Service. The chart review reproduced here is adapted from Mr. Solon's talks at the Commission's 1956 meeting in New York City, February 9, and at the Biennial Round Table Conference of the American Public Welfare Association, December 3, 1955, Washington, D. C.

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varying connotations among the States. The range of variation was substantially narrowed by application of uniform definitions. Nevertheless, the deeply ingrained local connotations produced some varying interpretation of those definitions.

Generally, however, the types of establishments construed in the study as proprietary nursing homes include those which are defined as "skilled nursing homes" together with those defined as "personal care homes, with skilled nursing." The former provide skilled nursing care as their primary function; the latter furnish some skilled nursing care, but only as an adjunct to a primarily personal care function. These distinctions have been described in two articles in *Public Health Reports*: "Inventory of Nursing Homes and Related Facili-

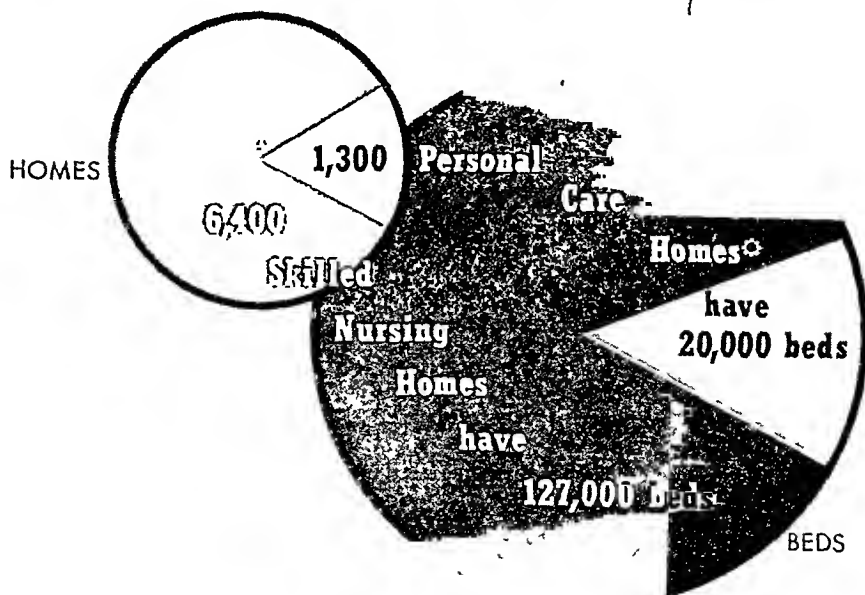
ties," December 1954, and "Ownership and Size of Nursing Homes," May 1955.

Briefly, skilled nursing care includes some technical nursing procedures beyond those which the untrained person can administer. Personal care includes such services as help in walking and getting in and out of bed, assistance with general bathing, help with dressing or feeding, preparation of special diet, supervision over medications which can be self-administered, and other types of personal assistance.

There are approximately 150,000 beds in proprietary nursing homes of the two types described, as shown in the chart below. Information about the patients and their care in essentially these types of homes in the 13 States surveyed is highlighted in the other charts.

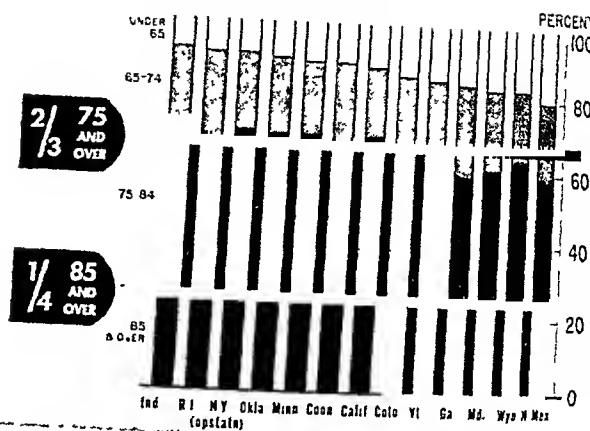
Proprietary  
Nursing  
Homes

## Number of homes and beds in the United States



\*providing a minor extent of skilled nursing

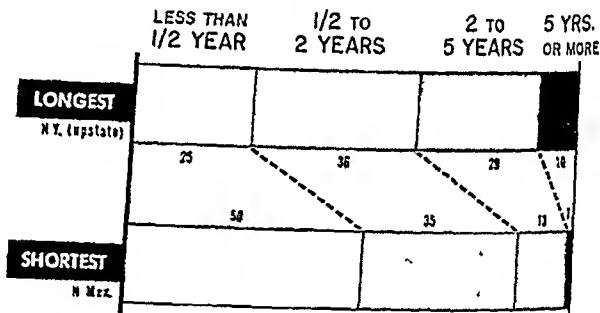
## AGE OF PATIENTS



## LENGTH OF STAY TO DATE

RANGE AMONG 13 STATES

PERCENT OF PATIENTS BY TIME SINCE ADMISSION



## DISABILITY AMONG PATIENTS

RANGE AMONG 13 STATES

SEVERELY  
LIMITED IN  
WALKING

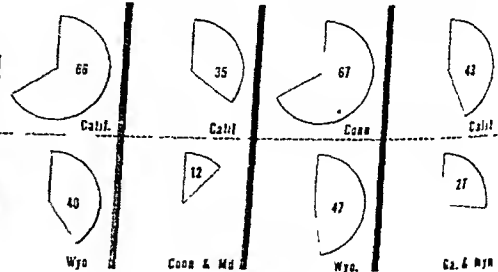
BEDFAST

MENTALLY  
CONFUSED

INCON-  
TINENT

**HIGHEST  
PERCENT**

**LOWEST  
PERCENT**



Without question nursing homes to-day serve a very aged group. Although in other respects sharp differences are observed among the States, in point of the patients' ages the various States present a remarkably uniform picture. The median age of patients in all of these States is about 80 years.

Relatively few patients—barely 10 percent nationally—are under 65 years of age. Only about 1 percent are less than 45 years.

The long periods of residence, along with the patients' advanced ages, emphasize that nursing homes are in a real sense a form of home for the aged.

The median length of residence of the patients in the homes at the time of the survey ranged from 6 months in New Mexico to 1½ years in upstate New York. Some patients stay many years—1 out of 10 of New York's patients had been admitted 5 or more years earlier.

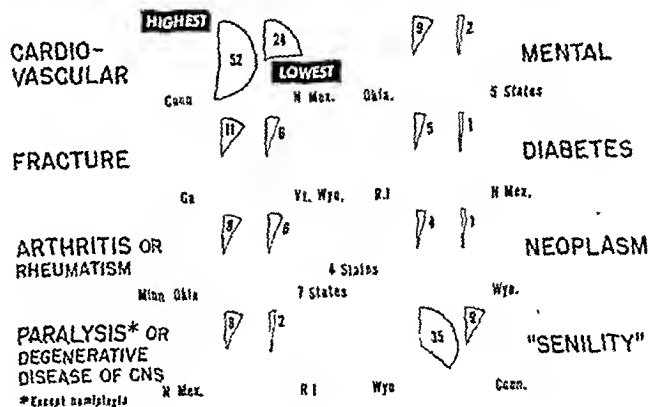
Nursing home patients are heavily disabled. About half of the patients are severely limited in ability to walk—they are unable to get about at all, or require some major assistance such as wheelchairs, walkers, or the help of attendants.

About one-fifth of the patients are completely confined to bed.

More than one-half are mentally confused, at least part of the time. One-third of the patients were found to be incontinent.

## DIAGNOSES - RANGE AMONG 13 STATES

PERCENT OF PATIENTS WHOSE PRIMARY CONDITION IS:



A few of the more common types of diagnoses reported for nursing home patients are shown. These represent only the major condition for which the patient is in the nursing home.

Cardiovascular conditions are the most common; heart diseases and stroke cases with hemiplegia are the major components among these.

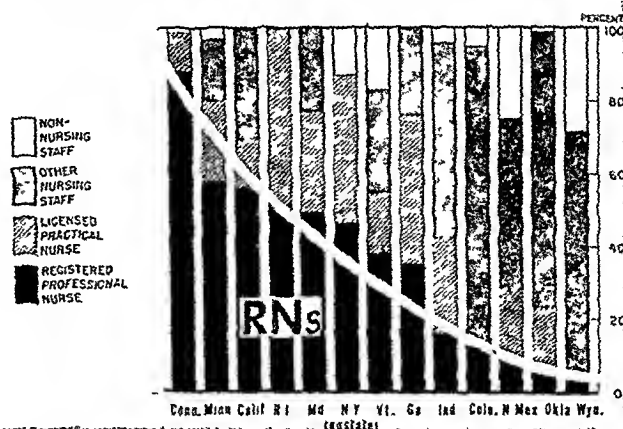
In all, it is the chronic diseases which characterize nursing home patients.

Information about the patients reveals a great deal about the character of the homes. Thus, this brief picture of the patients—aged, heavily disabled, chronically ill, destined for a prolonged stay—outlines a sharp image of the type of facility we have in the nursing home. Even the patients with fractures—normally regarded as an acute condition—usually have a fractured hip, requiring for the older person a prolonged period of care.

A particularly revealing aspect of the nursing home is highlighted by the frequency with which the nonspecific term "senility" is reported as a primary diagnosis for patients. It reflects in very large part the unavailability of more definitive diagnostic information. It points up the fact that the diagnoses reported by the nursing home administrators often lack the backing of medical records or even of medical examination. In what follows we shall see something of the character of the care rendered and of the nature of its medical orientation.

## PERCENT OF HOMES BY HIGHEST SKILL-LEVEL OF STAFF

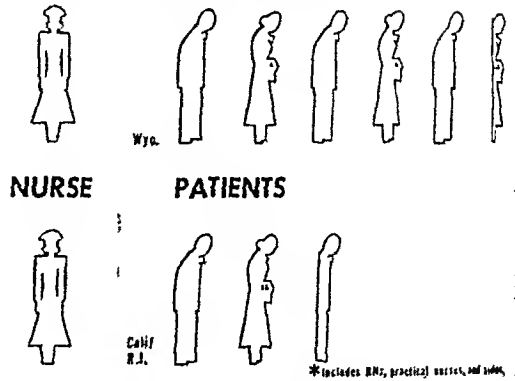
The sharp sweep of the curve marking off the proportion of homes which have a registered professional nurse tells a striking story. Connecticut, at one end of the curve, has a registered nurse in practically every nursing home—in fact, Connecticut prefers to call nursing homes "chronic and convalescent hospitals." At the other end of the curve are Wyoming and Oklahoma, where the home with a registered nurse is practically nonexistent.



## AVERAGE NUMBER OF PATIENTS PER NURSE\*

RANGE AMONG 13 STATES

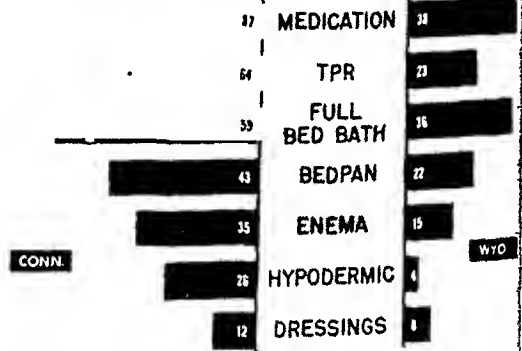
Also important is the number of staff available, in relation to number of patients. The ratio of patients to nurses of all types varies significantly among the States. In California and Rhode Island we find an average of 2.5 patients per nurse (Connecticut is close to this figure with 2.9 patients). Wyoming, at the other extreme, averages 5.2 patients per nursing staff member.



This view of certain nursing services ordinarily given in nursing homes is in key with characteristic differences among States revealed by some of the other charts. The proportion of patients who receive these particular services is shown for Connecticut and Wyoming, two States which frequently appear at opposite poles on the other measures. Much larger proportions of Connecticut's patients receive these services than Wyoming's patients.

## NURSING SERVICES RECEIVED

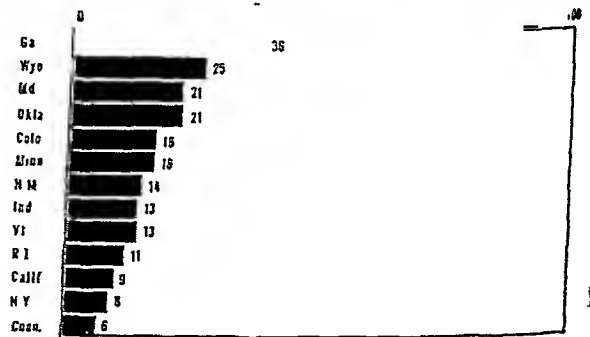
PERCENT OF PATIENTS RECEIVING:



The extent to which patients are under close, continuing medical supervision may be a crucial indicator of the general character of nursing homes. Large numbers of the patients are in fact infrequently attended by physicians. The proportion who have not been seen by a physician in as long as 6 months or more mounts in some of the States to one-fifth, one-fourth, and even as much as one-third of the patients.

## ATTENDANCE BY PHYSICIANS

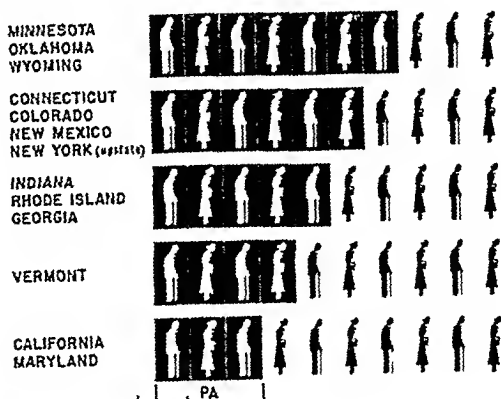
PERCENT OF PATIENTS NOT SEEN IN 6 MOS. OR MORE





## PUBLIC ASSISTANCE RECIPIENTS OUT OF EVERY 10 PATIENTS

Public welfare funds pay for the care of about half of all patients in proprietary nursing homes. In none of the 13 study States do public assistance recipients represent less than one-fourth of the patients. And in several of these States, as many as 7 out of 10 patients are paid for from welfare funds, usually with no other support.

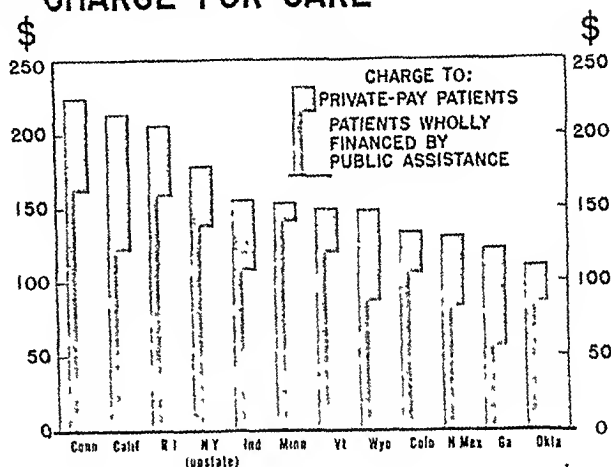


There is consistently a discrepancy between the median payment for care made by public assistance agencies and the average amount paid by patients from their own funds. In some States, the welfare payment is only about half the private-pay average.

Although some of the difference may stem from the luxury accommodations private-pay patients may select, statutory and budgetary ceilings on public assistance payments are known to be a prime factor.



## AVERAGE MONTHLY CHARGE FOR CARE



We have seen in this brief review that nursing homes are predominantly oriented toward long-term care, and toward an aged clientele. Their patients are characterized by a considerable degree of disability and by a multiplicity of chronic diseases.

We have observed the range in extent of staffing and intensity of nursing care. We have noted an apparent discrepancy between the character of the patient population on one hand and a relative lack of close and continuing medical attention on the other. Some fundamental implications for our concept of the nursing home role are related to the question of whether

or not nursing homes are medically oriented.

We have recognized that public welfare agencies are very heavily involved in financing nursing home care for public assistance recipients. With so large a proportion of the patients financed from this source, the welfare levels of payment must have a pervasive influence on the quality of care characteristic of nursing homes in general. How large a part public welfare agencies may have in the further development of nursing homes is suggested by their already important role in financing such care. The need for joint effort between the health and welfare agencies is all too apparent.

# Effect of Fluoridated Public Water Supplies on Dental Caries Prevalence

By FRANCIS A. ARNOLD, Jr., D.D.S., H. TRENDLEY DEAN, D.D.S.,  
PHILIP JAY, D.D.S., and JOHN W. KNUTSON, D.D.S., Dr.P.H.

AS EARLY as 1942, it had been adequately demonstrated that the use of fluoride-bearing drinking waters produces a marked reduction in the incidence of dental caries. It was also known by that time that this beneficial effect occurs in populations using water supplies containing fluoride from natural sources in concentrations below the level established as the threshold for mottled enamel or endemic fluorosis (1).

These epidemiological studies suggested the hypothesis that the addition of fluorides to public water supplies would result in a substantial reduction in dental caries. To test this hypothesis and to evaluate the procedure as a method

of caries control, several studies were begun in 1944-45. One of these studies is the Grand Rapids-Muskegon study, conducted by the Public Health Service with the cooperation of the Michigan Department of Health, the University of Michigan, and the city officials of Grand Rapids and Muskegon, Mich. This paper summarizes some of the findings from 10 years of observation in that study.

## General Procedure

As originally planned the Grand Rapids-Muskegon study was designed to continue for a period of 10 to 15 years. This period was selected so that observations would be comparable to those obtained in the basic epidemiological studies on children 12 through 14 years of age with a continuous history of using fluoridated water. The selection of the study areas, the methods and types of examinations, the selection of the annual study groups, and preliminary findings have been reported (2, 3).

Beginning in January 1945, sodium fluoride has been added to the water supply of Grand Rapids, the principal study area. Since that time the fluoride content of the water supply has been maintained at a concentration level of 1 p.p.m. (within the range 0.9 to 1.1 p.p.m.). The water supply at Muskegon, the control area, contained less than 0.2 p.p.m. of fluoride until July 1951. At that time Muskegon began adding fluoride to its water supply to maintain a level similar to that in Grand Rapids. (In this paper, parts per million of fluoride refers to the concentration of the fluoride ion.)

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*The following dental officers of the Public Health Service conduct the annual dental examinations in the Grand Rapids-Muskegon study: Dr. Robert C. Likins, Dr. A. L. Russell, Dr. David B. Scott, Dr. D. E. Singleton, and Dr. Robert M. Stephan. The following dentists, formerly with the Public Health Service, also participated as examiners in the study: Dr. F. S. Loe, Los Angeles, Calif.; Dr. H. B. McCauley, Baltimore, Md.; Dr. S. J. Ruzicka, Cleveland, Ohio; and Dr. Edwin M. Short, Hyattsville, Md.*

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To establish the caries status of the study population before fluoridation of the waters, complete oral examinations with a mouth mirror and explorer were made of virtually all children enrolled in elementary and secondary schools in Grand Rapids and Muskegon in 1944 and 1945. Each year thereafter, similar examinations have been made of selected samples of children in the two areas. (Bite-wing roentgenographic and bacteriological studies on selected samples of children will be reported in subsequent papers.) To provide an "expectancy curve," complete oral examinations were also made, in 1945 and 1946, of school chil-

dren in Aurora, Ill., where it is known the water supply has contained 1.2 p.p.m. fluoride from natural sources for about 50 years.

The annual samples of the school population of Grand Rapids and Muskegon are taken from schools selected as representative of each city as a whole. The samples consist of all available children in certain grades (or in sections of the grades) in these schools. The grades are selected to yield certain age groups. The number of grades has been expanded each year so that for the 10th year of the study a representative sample of children at each age from 5 through 16 years was obtained. The grades

**Table 1. Distribution of continuous resident children examined in Grand Rapids and Muskegon, Mich., according to age, by year of examination**

Age last birthday <sup>1</sup>	Basic examinations, 1944-45	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954
Grand Rapids, Mich.											
4.....	323	540	300	168	137	75	117	168	116	101	77
5.....	1,633	1,714	831	886	842	777	720	853	1,087	715	529
6.....	1,789	1,186	628	663	736	697	748	750	826	1,010	561
7.....	1,806	149	82	69	55	54	438	423	422	410	751
8.....	1,647	15	216	135	138	155	501	470	444	390	567
9.....	1,639	0	525	465	484	519	520	582	720	623	477
10.....	1,626	0	109	108	111	125	131	141	512	499	515
11.....	1,556	0	17	18	22	140	130	151	246	291	499
12.....	1,685	174	85	38	60	130	200	176	211	316	260
13.....	1,668	953	547	625	600	574	530	497	497	557	224
14.....	1,690	273	173	196	152	153	130	128	119	111	250
15.....	1,511	80	53	80	64	64	58	53	80	99	240
16.....	1,107	4	3	233	245	209	177	198	191	197	198
Total.....	19,680	5,088	3,569	3,684	3,646	3,672	4,400	4,590	5,471	5,319	5,148
Muskegon, Mich. <sup>2</sup>											
4.....	20	-----	43	18	26	51	41	63	52	43	40
5.....	402	-----	321	348	422	340	359	351	487	370	381
6.....	462	-----	339	312	305	393	310	294	353	397	386
7.....	408	-----	36	42	36	30	274	223	246	209	292
8.....	376	-----	18	13	10	12	190	275	205	212	244
9.....	357	-----	213	215	199	197	227	277	348	258	275
10.....	359	-----	62	57	52	52	51	62	287	311	226
11.....	293	-----	12	10	14	146	141	139	133	175	208
12.....	328	-----	21	19	11	28	43	48	46	163	183
13.....	377	-----	197	207	208	214	173	225	178	228	243
14.....	369	-----	77	50	79	66	63	59	54	51	121
15.....	292	-----	18	44	41	34	35	21	30	35	139
16.....	248	-----	1	199	205	132	146	155	132	161	185
Total.....	4,291	-----	1,358	1,534	1,608	1,695	2,053	2,192	2,551	2,613	2,923

<sup>1</sup> See reference 1 for information regarding the effect of selection of sample by grades on specific age groups.

<sup>2</sup> The basic examinations in Muskegon were not done until late spring of 1945; therefore, no examinations were made in the fall of 1945.

selected for the annual examinations are as follows:

Year	Grade
1945-----	Kindergarten, 1, 8
1946-----	Kindergarten, 1, 4, 8
1947-----	Kindergarten, 1, 4, 8, 11
1948-----	Kindergarten, 1, 4, 8, 11
1949-----	Kindergarten, 1, 4, 6, 8, 11
1950-----	Kindergarten, 1, 2, 3, 4, 6, 8, 11
1951-----	Kindergarten, 1, 2, 3, 4, 6, 8, 11
1952-----	Kindergarten, 1, 2, 3, 4, 5, 6, 8, 11
1953-----	Kindergarten, 1, 2, 3, 4, 5, 6, 7, 8, 11
1954-----	Kindergarten through 11

Each year of the study, all available children in the selected grades (or section thereof) in each school in the study received dental examinations. Only the records of children aged 4-16 years who had used city water supplies continuously since birth are included in this report. Not included are records of children who lived outside their respective communities

for more than 3 months in any one calendar year. The number of continuous resident children and their distribution by age for each year of the study are shown in table 1.

## Results

The amount of dental caries observed at each annual examination through 1954 in Grand Rapids and in Muskegon is shown in tables 2 and 3. There has been a striking reduction in the amount of dental caries in both the deciduous and permanent teeth. For example, in 1944 the average 6-year-old child had 6.43 def (decayed, extraction indicated, or filled) deciduous teeth; in 1954 the average child had only 2.95 def teeth. This represents a reduction of about 54 percent. Similar results were observed in the permanent teeth of children born since fluoridation started; that is those 6 to

Table 2. Average number of def<sup>1</sup> deciduous teeth per child<sup>2</sup> in Grand Rapids and Muskegon, Mich., by year of examination

Age last birthday	Basic examinations, 1944-45	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954
Grand Rapids, Mich.											
4-----	4.19	5.40	3.43	3.19	3.02	2.75	2.46	2.13	2.17	2.06	2.12
5-----	5.37	6.15	5.08	3.89	4.03	3.27	2.50	2.27	2.32	2.29	2.50
6-----	6.43	6.98	5.73	5.38	4.78	4.50	3.73	2.98	2.93	2.92	2.95
7-----	6.29	7.66	6.11	5.84	5.20	4.83	5.72	4.03	3.48	3.10	3.26
8-----	5.78	8.00	5.10	5.07	4.88	4.75	4.91	4.12	3.89	3.48	3.31
9-----	4.59	-----	4.45	4.11	4.43	4.41	4.23	3.86	3.66	3.35	3.60
10-----	2.84	-----	2.84	3.16	3.06	2.86	2.36	2.43	2.61	2.38	2.35
11-----	1.35	-----	2.12	2.78	1.77	1.19	1.16	1.35	1.51	1.90	1.32
12-----	.47	.28	.13	.11	.25	.35	.25	.30	.34	.44	.44
13-----	.18	.13	.14	.14	.17	.10	.15	.12	.17	.19	.18
Muskegon, Mich. <sup>3</sup>											
4-----	5.05	-----	3.44	4.67	4.39	4.41	5.32	4.46	4.35	3.44	3.03
5-----	6.82	-----	5.86	5.05	5.55	5.56	5.65	5.25	5.39	4.42	3.98
6-----	7.17	-----	6.24	6.18	6.06	5.99	6.02	5.67	5.75	5.71	4.85
7-----	6.66	-----	6.83	5.95	6.92	6.33	5.83	5.77	5.67	5.46	5.35
8-----	6.06	-----	4.83	3.85	4.80	6.08	5.06	5.32	5.28	4.95	4.98
9-----	4.89	-----	4.32	4.34	4.71	4.48	4.09	4.17	4.36	4.29	3.81
10-----	3.08	-----	3.15	3.67	2.79	2.77	3.49	2.86	2.69	2.96	2.75
11-----	1.33	-----	1.67	2.90	.64	1.21	1.09	1.46	1.20	1.38	1.42
12-----	.42	-----	.14	.37	.64	.68	.61	.31	.54	.32	.61
13-----	.23	-----	.29	.17	.11	.11	.13	.15	.08	.21	.12

<sup>1</sup> Decayed, extraction indicated, or filled deciduous teeth. A decayed and filled tooth is counted only once.

<sup>2</sup> See table 1 for small numbers involved in some instances.

<sup>3</sup> The basic examinations in Muskegon were not done until late spring of 1945; therefore, no examinations were made in the fall of 1945.

Table 3. Average number of DMF<sup>1</sup> permanent teeth per child<sup>2</sup> in Grand Rapids and Muskegon, Mich., by year of examination

Age last birthday	Basic examinations, 1944-45	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954
Grand Rapids, Mich.											
6	0.78	0.56	0.23	0.37	0.26	0.38	0.26	0.26	0.23	0.12	0.19
7	1.89	1.72	1.11	1.09	1.04	.76	1.03	.84	.90	.71	.69
8	2.95	3.27	2.54	2.62	2.30	2.16	1.77	1.58	1.50	1.41	1.27
9	3.90		2.98	3.12	2.67	2.48	2.38	2.04	2.02	1.83	1.97
10	4.92		3.70	3.56	3.51	3.56	3.17	2.93	2.71	2.41	2.34
11	6.41		4.24	3.56	4.32	4.69	4.36	3.67	3.49	3.12	2.98
12	8.07	9.53	7.62	7.03	8.32	7.02	7.10	5.89	5.04	4.76	3.87
13	9.73	10.76	8.92	8.47	8.34	8.11	7.21	6.60	5.87	5.12	5.05
14	10.95	11.90	9.41	9.50	9.41	8.90	8.55	8.21	7.23	5.92	6.78
15	12.48	12.68	11.26	11.94	10.61	11.80	10.12	8.91	9.04	9.75	8.07
16	13.50	13.00	9.33	12.47	13.50	11.83	11.35	11.06	10.14	9.53	9.95
Muskegon, Mich. <sup>3</sup>											
6	0.81		0.48	0.66	0.79	0.63	0.75	0.80	0.52	0.35	0.45
7	1.99		1.33	1.05	2.19	1.43	2.01	1.88	1.66	1.24	1.14
8	2.81		2.83	2.15	3.50	2.58	2.96	2.63	2.49	2.66	2.18
9	3.81		3.29	3.54	3.58	3.88	3.99	3.52	3.05	3.22	3.16
10	4.91		4.27	3.60	4.87	4.44	4.53	4.32	3.90	3.64	3.72
11	6.32		4.25	4.70	4.71	5.93	5.67	5.34	5.04	4.70	4.58
12	8.66		8.43	6.79	7.82	7.21	6.88	7.71	7.00	6.53	6.12
13	9.98		9.02	9.23	10.52	9.52	9.58	9.36	8.71	8.20	7.98
14	12.00		11.09	12.00	12.27	11.08	12.11	11.36	10.06	10.35	10.74
15	12.86		11.17	12.89	12.66	10.32	10.94	12.38	11.57	11.69	11.19
16	14.07		19.00	12.77	14.31	12.51	13.91	13.16	12.36	11.48	12.55

<sup>1</sup> Decayed, missing, or filled permanent teeth. A decayed and filled tooth is counted only once.

<sup>2</sup> See table 1 for small numbers involved in some instances.

<sup>3</sup> The basic examinations in Muskegon were not done until the late spring of 1945; therefore, no examinations were done in the fall of 1945.

10 years old. It should be noted also that some beneficial effect was obtained by the older children. For example, the 16-year-old children had an average of 13.50 DMF (decayed, missing, or filled) permanent teeth in 1944 and 9.95 in 1954. They were between 6 and 7 years of age when fluoridation started.

A breakdown of the dental caries experience rates for 1954 in the two cities is shown in table 4. For comparison with these results, table 5 offers the findings in 1945 among Aurora, Ill., children, who had used a naturally fluoridated water since birth. The caries experience observed among them is similar to that reported for other areas with fluorides of that concentration (1).

Prior to the decision to add fluoride to the water supply at Grand Rapids, it was concluded that the procedure would not produce an un-

desirable cosmetic effect, that is, mottled enamel. However, it was recognized that an increase in the milder, nonobjectionable forms of dental fluorosis was likely. In order to evaluate this factor fully, it is necessary to wait for observations on all permanent teeth (excluding third molars) which are calcified on fluoridated water. The observations to date give evidence of only a slight increase (0.24 percent in 1944; 0.36 percent in 1954) in the number of children with the milder forms of fluorosis, which are not objectionable from an esthetic or cosmetic standpoint.

## Discussion

From the results obtained in Grand Rapids after 10 years of water fluoridation, it is quite clear that this procedure is remarkably effec-

tive in reducing the incidence of dental caries. These observations are in accord with the results of similar studies conducted under separate auspices (4-6). The scientific evidence is conclusive, therefore, that water fluoridation is an effective public health procedure for producing a substantial reduction in the incidence of dental caries.

According to this study, the beneficial effects of fluoridated water are not confined to persons drinking the water since birth. The results suggest that some benefit was obtained by per-

sons whose teeth had already formed or erupted when they started drinking fluoridated water. The effects on the teeth of adults in these cities have not as yet been ascertained. However, the fact that a reduction in caries was observed for teeth which had already been calcified when fluoridation was started indicates that some beneficial effect may be gained by older age groups.

The possibility of an increase in dental fluorosis in a community after fluoridation has received considerable discussion. After 10 years

**Table 4. Dental caries in deciduous and permanent teeth of continuous resident children of Grand Rapids and Muskegon, Mich., as observed in the 1954 examination**

Age last birthday	Number of teeth per child						Percent of caries-free children <sup>4</sup>
	Deciduous teeth		Permanent teeth				
	Filled	Total def <sup>1</sup>	Decayed	Missing <sup>2</sup>	Filled	Total DMF <sup>3</sup>	
Grand Rapids, Mich.							
4	0.68	2.12					
5	1.14	2.50	0.01		0.01	0.02	99.4
6	1.30	2.95	.11		.09	.19	89.3
7	1.45	3.26	.36		.35	.69	66.8
8	1.42	3.31	.52	0.02	.77	1.27	49.4
9	1.30	3.00	.74	.04	1.26	1.97	33.1
10	.98	2.35	.73	.07	1.63	2.34	26.6
11	.63	1.32	.78	.10	2.19	2.98	16.8
12	.12	.44	1.14	.26	2.55	3.87	13.5
13	.04	.18	1.56	.44	3.23	5.05	10.7
14			2.13	.52	4.36	6.78	5.6
15			2.08	1.02	5.23	8.07	1.2
16			1.96	1.35	6.90	9.95	2.0
Muskegon, Mich. <sup>5</sup>							
4	1.18	3.03					
5	.98	3.98	0.03			0.03	98.4
6	1.64	4.85	.33	0.00	0.13	.45	79.8
7	1.96	5.35	.74	0	.41	1.14	49.7
8	2.03	4.98	1.23	.06	.95	2.18	27.5
9	1.60	3.81	1.29	.14	1.80	3.16	14.5
10	1.14	2.75	1.44	.23	2.20	3.72	5.7
11	.44	1.42	1.79	.32	2.67	4.58	4.3
12	.14	.61	2.05	.42	3.85	6.12	4.4
13	.06	.12	2.47	.72	4.97	7.98	1.6
14			4.31	1.39	5.31	10.74	0
15			3.55	1.42	6.51	11.19	1.4
16			2.78	1.42	8.77	12.55	1.1

<sup>1</sup> Decayed, extractions indicated, or filled deciduous teeth.

<sup>2</sup> Includes teeth listed as "remaining roots" and teeth destroyed beyond any possible repair.

<sup>3</sup> Decayed, missing, or filled permanent teeth; each tooth is counted only once for this total. A tooth that has both a filled and a carious surface is included in both the "Decayed" and the "Filled" columns.

<sup>4</sup> Permanent teeth only.

<sup>5</sup> These children had already received the beneficial effects of 3 years of water fluoridation (see text).

Table 5. Dental caries in deciduous and permanent teeth of continuous resident children of Aurora, Ill., as observed in the 1945-46 examination period

Age last birthday	Number children examined	Deciduous teeth		Permanent teeth				Percent of caries-free children <sup>4</sup>
		Filled	Total def <sup>1</sup>	Decayed	Missing <sup>2</sup>	Filled	Total DMF <sup>3</sup>	
		Number of teeth per child						
4	30	0.10	2.07					
5	407	.25	2.79	0.06			0.06	97.3
6	473	.38	3.36	.27	0.00	0.02	.28	84.8
7	516	.44	3.51	.68	.01	.04	.71	66.1
8	469	.54	3.60	.95	.01	.11	1.04	55.2
9	368	.49	2.98	1.27	.06	.27	1.52	44.8
10	397	.27	2.28	1.55	.09	.51	2.02	33.5
11	383	.15	1.18	2.03	.23	.69	2.67	27.7
12	401	.05	.43	2.06	.22	.96	2.95	26.9
13	401	.01	.13	2.10	.24	1.20	3.09	26.7
14	433			2.05	.31	1.58	3.64	21.7
15	467			2.37	.50	2.05	4.54	16.9
16	371			2.32	.53	2.71	5.19	14.6

<sup>1</sup> Decayed, extraction indicated, or filled deciduous teeth.

<sup>2</sup> Includes teeth listed as "remaining roots" and teeth destroyed beyond any possible repair.

<sup>3</sup> Decayed, missing, or filled permanent teeth; each tooth is counted only once for this total. A tooth that has both a filled and a carious surface is included under both the "Decayed" and the "Filled" columns. (Note that this table differs from table 2, reference 2.)

<sup>4</sup> Permanent teeth only.

of fluoridation in Grand Rapids, the percentage of children classed as having fluorosis has increased, but, as anticipated, this increase is confined to the milder forms. As pointed out previously (7), the signs of the milder forms of fluorosis caused by ingestion of water containing 1 p.p.m. fluoride as a rule do not appear on the anterior teeth. It is the plan of this study to continue the observations to evaluate this factor fully. Thus far, however, the ingestion of the Grand Rapids water supply has not produced any undesirable cosmetic effect in the form of objectionable dental fluorosis on the anterior teeth.

### Summary

The results of the Grand Rapids-Muskegon study after 10 years of observation indicate that the adjustment of the fluoride content of a communal water to an optimal level (approximately 1 p.p.m. fluoride) will produce the following effects:

1. A striking reduction in the prevalence of dental caries in the deciduous teeth. At the

peak of prevalence, namely 6 years of age, the caries rate for the deciduous teeth was reduced by about 54 percent.

2. A marked reduction in the prevalence of dental caries in the permanent teeth. In children born since fluoridation was put into effect, the caries rate for the permanent teeth was reduced on the average by about 60 percent.

3. Some benefit among persons whose teeth having already formed or erupted when fluoridation is begun.

4. No undesirable cosmetic effect from dental fluorosis.

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## PHS films

### The Public Health Aspects of Migrant Workers

16 mm. Film, black and white, sound, 16 minutes, 1955.

Audience: Public health workers, medical societies.

Available: Loan—Public Health Service, Communicable Disease Center, 50 7th St. NE., Atlanta 23, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

Instruction in the detection and control of communicable diseases in migrant laborers is provided through this film. National problems in controlling diseases associated with this

shifting group are elucidated. These problems have, for many years, been growing.

Since migrant laborers are transients, they do not ordinarily enjoy the rights of citizenship. Any attempt to solve such problems must, therefore, transcend legal obligations to protect the health of citizens.

### Infectious Hazards of Bacteriological Techniques Series: Part VI, The Centrifuge

35 mm. Filmstrip, color, sound, 12 minutes, 86 frames, 1955.

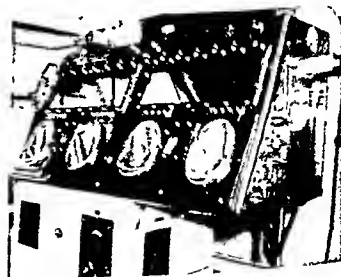
Audience: Laboratory or institutional personnel using or teaching the use of the centrifuge in handling infectious organisms.

Available: Loan—Public Health Service, Communicable Disease Center, 50 7th St., NE., Atlanta 23, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

This is one of a series of filmstrips relating to studies of infec-



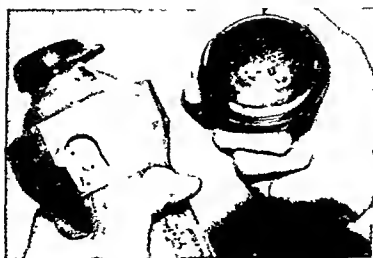
Air samplers placed to determine aerosol contamination at various distances from centrifuge.



Ventilated cabinet developed at Fort Detrick to house refrigerated centrifuge.



Truck showing mode of travel of migrant laborers. Two families of 10 or 12 people traveled 1,000 miles in one of these to get to summer work.



Safety cup used to prevent dissemination of aerosols from tubes broken in centrifuge.

tious aerosols produced by common laboratory operations.

Based on data gathered by the Army's Chemical Corps Biological Laboratories, Fort Detrick, this particular part deals specifically with the centrifuge. It points out some of the hazards of using this apparatus and suggests safe operating procedures.

# Microbiological Safety

By MORTON REITMAN, Ph.D., and A. G. WEDUM, M.D., Ph.D.

LABORATORY workers often have acquired infections during microbiological investigations. A 1951 survey of 1,342 laboratory-acquired infections in the United States revealed 39 deaths, a case fatality rate of about 3 percent (1). In all, recognizable accidents in the laboratory accounted for only 215, or 16 percent, of the infections. The source of most of the illnesses was unknown.

Although literature on industrial and chemical hazards is abundant, little has been published on microbiological hazards until recently (2-9). The Fort Detrick Laboratory Hazards Section, necessarily concerned with the prevention of laboratory infections, has attempted to determine their causes. From observations and from experimentation on infectious laboratory hazards, safety ideas have been developed which may be helpful in decreasing the number of laboratory-acquired illnesses.

## Aerosol Determination

Studies of the potential sources of infection have centered on the hazards associated with common laboratory techniques. The experimental method used has been described previously (5, 7). Essentially, this method involves sampling air with the sieve-type air sampler during standard bacteriological operations such

as pipetting, centrifuging, inoculating and lyophilizing cultures, and autopsy of animals. The operational area is surrounded by samplers, each of which draws air at the rate of 1 cu. ft. per minute through 340 small openings, thereby impinging organisms on the surface of a petri dish agar plate 1-2 mm. below the openings. After a suitable incubation period (36-48 hours at 30° C. for bacteria and 4-16 hours at 30° C. for bacteriophage) colonies or plaques are counted in a Quebec colony counter.

Contamination of the environment is determined also by swabbing surfaces with cotton moistened with nutrient broth. The swabs are streaked on agar plates, which are then incubated as are the air-sampler plates.

Three easily identified organisms were used in these studies: (a) *Serratia indica*, a red pigmented vegetative rod; (b) *Bacillus subtilis* var. *niger*, designated *B. globigii* in Fort Detrick laboratories; and (c) coliphage T<sub>3</sub>. *S. indica* and *B. subtilis* spores were sampled on corn-steep, molasses agar, and coliphage T<sub>3</sub> on tryptose phosphate glucose agar (7).

## Area Contamination Found

Wide variations from average determinations of contamination hazards associated with laboratory procedures are possible (see table). These variations often seem to depend on minor changes in technique peculiar to the individual testing a particular procedure. A reported count of two, for example, means that two colonies grew on the agar sampling plates. It has been reported that most bacteria in the air occur in clumps (10). Also, the efficiency of the sieve

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# Aerosols produced by common bacteriological techniques

Technique	Number of colonies appearing on san plates			
	Number of operations	Average	Minimum	Maximum
Agglutination, slide drop technique (one slide)-----	60	0.3	0	
Animal injections ( <i>Serratia indica</i> ):				
1. 10 shaved guinea pigs injected intraperitoneally with 0.5 ml. culture, no disinfectant-----	3	15	15	
2. Same as (1) but injection site disinfected before and after injection with 1 percent tincture of iodine-----	3	0	0	
Autopsy, guinea pig:				
1. Immediately after 1 ml. <i>S. indica</i> culture injected intraperitoneally-----	2	4.5	3	
2. Immediately after 10 ml. culture injected intracardially-----	6	3	1	
3. Grinding tissue 2 minutes in mortar and pestle with 2 ml. sterile broth:				
Guinea pig liver as in (1), 10 ml. inoculum-----	10	1.8	0	
Guinea pig heart as in (2)-----	6	19.5	0	10
Centrifuging:				
1. Pipetting 10 ml. <i>S. indica</i> culture into 50 ml. tube-----	100	.6	0.1	
2. Pipetting 30 ml. culture into 50 ml. tube-----	100	1.2	0	
3. Removal of one cotton plug after centrifuging-----	100	2.3	.8	
4. Removal of one rubber cap after centrifuging-----	80	.025	0	
5. Decanting supernatant into flask-----	10	17.6	0	11
6. Siphoning supernatant from 10 tubes, each containing 30 ml. centrifuged culture-----	100	3	0	24
7. Adding 30 ml. saline to one tube of packed centrifuged cells and resuspending by mixing by alternate sucking and blowing with a pipette-----	100	4.5	.7	12
8. One 50 ml. tube breaking in centrifuge but all 30 ml. culture staying in trunnion cup-----	10	4	0	20
9. As in (8) but culture splashing on side of centrifuge-----	10	1,183	80	1,800
10. Swabbing outside of centrifuge tubes after filling, centrifuging, taking off supernatant, and resuspending-----	10	(1)		
One drop of <i>S. indica</i> culture falling 3 inches onto:				
1. Steel surface-----	200	1.3	.02	4
2. Painted wood-----	200	.3	.01	.1
3. Kem-rock-----	100	.04	.00	.1
4. Dry hand towel-----	100	.16	.00	.3
5. Dry paper towel-----	200	.11	.00	.3
6. Dry wrapping towel-----	100	.02	.00	.6
7. Towel wet with 5 percent phenol-----	100	.02	.00	.0
8. Pan of 5 percent phenol-----	100	.00	.00	.0
Inoculating loop:				
1. Streaking one agar plate with one loopful of <i>S. indica</i> broth culture-----	10	.6	0	20
2. Streaking one agar plate with one loopful of agar culture-----	15	4.6	0	.7
3. Loopful of broth culture striking edge of tube-----	15	.26	0	2.3
4. Inserting one hot loop into 100 ml. culture in a 250 ml. Erlenmeyer flask-----	550	8.7	.68	25
5. Inserting one cold inoculating loop into 100 ml. culture in a 250 ml. Erlenmeyer flask-----	250	.08	0	.22

sampler in recovering aerosolized particles of heterogeneous size and composition under varying humidities is not easily nor precisely determinable. In the presence of bacterial aerosols of known concentrations, efficiencies have varied from 43 to 73 percent. Therefore, the reported number of colonies is significantly smaller than the actual number of bacteria.

It is evident that certain procedures create

larger amounts of aerosols than others. Grinding tissue with mortar and pestle, decanting the supernatant after centrifugation, resuspending packed cells, inserting a hot loop in a culture, withdrawing a culture sample from a vaccine bottle, opening a lyophile tube, streaking an inoculum on a rough agar surface, and shaking and blending cultures in high-speed mixers appear to be potentially dangerous to the tech-



# Aerosols produced by common bacteriological techniques—Continued

Technique	Number of colonies appearing on sampler plates			
	Number of operations	Average	Minimum	Maximum
Hypodermic syringe and needle [withdrawing 1 ml. phage suspension from rubber-capped vaccine bottle and making ten-fold dilutions in rubber-capped vaccine bottles ( $10^{-1}$ to $10^{-9}$ ), pledget does not always protect fingers against contamination]:				
1. Cotton pledget around needle	90	2.3	0	10
2. Ethanol soaked cotton pledget	90	0	0	0
Lyophilization:				
1. Breaking one ampule containing 2 ml. of lyophilized <i>S. indica</i> culture in milk plus broth menstruum by dropping on the floor, first 10 minutes	10	2,029	1,939	2,040
2. Same as (1), 50-60 minutes after breakage	10	741	162	1,447
3. Opening one lyophile tube by filing and breaking tip	20	86	4	256
4. Same as (3), but wrapped in 70 percent ethanol soaked cotton pledget	50	.08	0	.8
5. Transferring one dry inoculum from one lyophile tube by wire loop	50	1.0	0	5
6. Same as (5), but shaking powder into broth tubes	20	5.4	0	30
7. Same as (5), but wet inoculum transferred by syringe and needle after reconstituting with one ml. broth	10	4.4	0	17
Petri dish plates:				
1. Preparation of pour plate, pipetting one ml. inoculum of <i>S. indica</i> into plate without blowing, and adding melted agar and mixing	15	2.6	.2	5
2. Streaking one smooth agar plate with 0.1 ml.; spread with glass rod	50	.06	0	.4
3. Streaking one rough agar plate with one loopful of broth culture	10	25.1	7	73
4. Same as (3), but using 0.1 ml. and glass rod	50	8.7	2	25
Pipettes (also see centrifuging.):				
1. Inoculating 50 ml. broth in 125 ml. Erlenmeyer flask with 1 ml. culture ( <i>S. indica</i> )	5	1.2	0	2
2. Mixing 7 ml. broth culture by alternate suction and blowing, without forming bubbles	5	.2	0	1
Plug, stopper, or cap removed from culture container of 1-10 dilution of 24-hour broth culture of <i>S. indica</i> :				
1. Escher rubber stopper removed from 5-oz. square dilution bottle immediately after shaking up and down	15	5.0	0	20
2. Same as (1), stopper removed after 30 seconds wait	15	2.5	0	12
3. Plastic screw cap removed from 8-oz. prescription bottle immediately after shaking	15	4.0	0	13
4. Cotton plug removed from 250 ml. Erlenmeyer flask immediately after rotary shaking (dry plug)	15	5.0	0	16
5. Same as (4), but wet plug	5	10.2	0	35
High speed blender, <i>S. indica</i> culture mixed 2 minutes:				
1. Screw-capped, no rubber gasket (1 minute)	10	8.7	0	31
2. Screw-capped, rubber gasket, worn bearing	10	61.0	12	126
3. Loose fitting plastic cover	15	518	77	>1,246
4. Removing tight cover immediately after mixing	15	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
5. Removing tight cover 1 hour after mixing	15	8.2	5	33

<sup>1</sup> Colonies too numerous to count.

<sup>2</sup> Two technicians.

nician if the micro-organisms are infectious. Accidents during centrifugation or handling of dried cultures caused extensive contamination of the laboratory. Practically every manipulation in the microbiological laboratory creates aerosols, and these aerosols are probably the source of many laboratory infections.

## Corrective Measures

### Bacteriological Cabinets

Protection from infectious particles disseminated into the environment surrounding their source may be afforded by a bacteriological safety cabinet, a modification of the hood or



Figure 1. This cabinet may be used without the glove-port panel when small amounts of aerosol are expected.

dry box used for chemical and radiological studies. All potentially infectious operations are thus carried out behind a plane of glass with ventilation sweeping contaminated air away from the technician. When the cabinet is to be used will depend upon the organism, the technique, the skill and immunity of the technician, the seriousness of the possible illness and its possible sequelae, and the relative isolation of the laboratory. A cabinet system is also advisable when there is potential repeated inhalation of large volumes of non-pathogenic micro-organisms. These occasionally cause hypersensitivity (11). Hypersensitivity is also known to develop during the repeated preparation of tuberculin and brucellergen. Nonpathogens have been reported to cause infection in man (12).

The bacteriological safety cabinet (13, 14) may be simple (fig. 1) or elaborate (fig. 2), depending on the need. When there is a large volume of work, special cabinets are justified for particularly hazardous equipment such as the centrifuge and shaking machines (figs. 3

and 4). Ultraviolet light provides partial disinfection of the cabinet interior; sterilization is best accomplished with steam formaldehyde.

Contaminated cabinet air may be filtered through a bacterial filter or piped directly to some sort of air incinerator. An electric grid



Figure 2. Modular gas-tight cabinet system—animal holding, all-purpose, and autopsy cabinets.

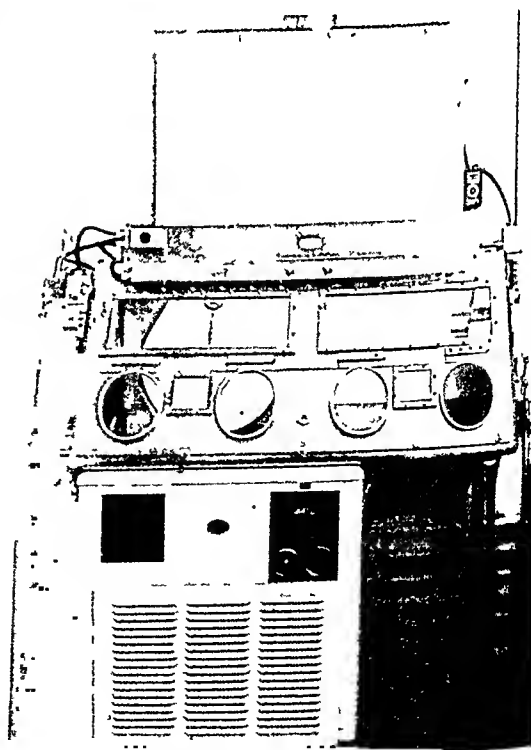


Figure 3. This centrifuge cabinet may alternatively be used as a bacteriological work cabinet.

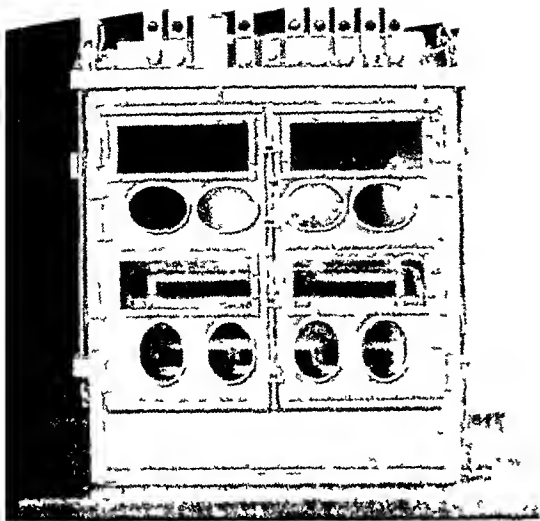


Figure 4. Model of shaking machine-incubator cabinet which may be used to house various types of apparatus.

incinerator (4) has been in use at the National Institutes of Health, Public Health Service, for some time. The efficiency of this incinerator has been reported (15). Individually designed gas or oil fired incinerators are useful for larger volumes of air. Sterilization before renewal or examination of the filter may be accomplished by incorporated electric strip heaters.

### *The Centrifuge*

For most laboratories, adequate centrifuge safety is possible by use of commercially available screw-capped, safety cups for the swinging head. The angle head in a refrigerated or nonrefrigerated centrifuge has required special attention; a new head has been designed with enlarged recesses to hold the safety cups and will soon be available (B). These cups should be filled and opened in a safety cabinet.

### *Animals and Cages*

Experimentally infected animals can be a source of infectious aerosols (16). Such animals are more safely housed in cages with solid bottoms and sides than in wire cages. A simple method for minimizing dissemination of infectious material is equipping cage racks with ultraviolet fixtures (fig. 5). It has been found that when these are adjusted so as to bathe the area immediately above the cage tops with con-

tinuous ultraviolet radiation at an intensity of about 250 microwatts per sq. cm. no viable vegetative organisms escape from the cages. A more expensive method uses ventilated cages in which all input and exhaust air is filtered (fig. 6).

Depending upon the animal, route of inoculation, cage, bedding, and the micro-organism, the accidental aerosol may not only be a hazard to the technician but may peril the validity of an experiment through cross inoculation of ani-

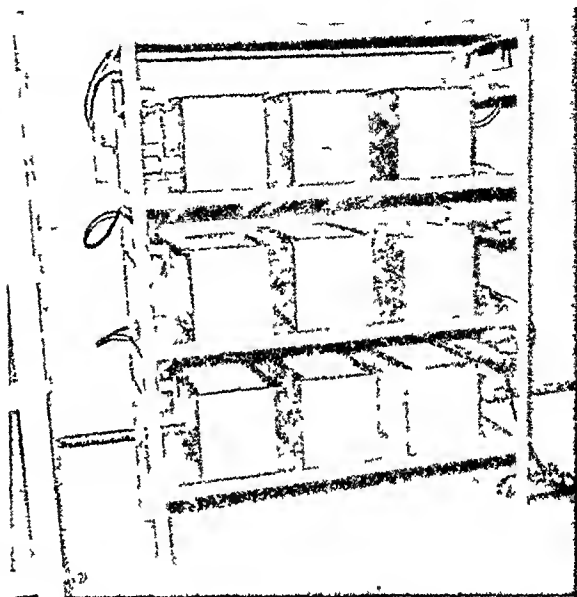


Figure 5. Ultraviolet screen across cage tops prevents escape of viable vegetative cells.



Figure 6. Filtered air is supplied to individual cages connected to negative pressure manifold.

nals or augmentation of the test inoculation (16). In some instances, it has become necessary to cage animals individually to insure the validity of an experiment. Before disturbing the debris or cleaning, cages should be disinfected or sterilized, depending upon the infectiousness of the organism.

### *The Pipette*

The pipette is a significant source of infection, more because of aspiration of liquid than because of inhalation of aerosol. To eliminate the possibility of aspiration and oral contamination, a pipetting device of some kind is desirable (17). There are many pipetting devices which are commercially available, for instance, the aba (C), Adams (D), and Kadavy (E) micropipettors and the aba (C), Canfield (F), and Fisher (G) pipettors. A new pipetting device which has found favor with the Fort Detrick personnel is the Propipette (H). A simple pipettor can be constructed from a short piece of rubber tubing, or a rubber bulb, such as those used to operate medicine droppers, may be used.

For a pipetting device to be suitable for handling infectious materials outside a safety cabinet, it should not deliver its liquid by forceful ejection, which may produce aerosols. Gravity flow delivery is given by the Canfield pipettor and the Propipette but not by the other devices mentioned. Contaminated pipettes should be placed in a tray large enough to allow their complete horizontal immersion under a layer of germicidal solution, and the tray should be autoclaved before removing the pipettes.

### *Other Equipment*

The infectious hazards associated with the use of high-speed mixing bowls have been investigated (5). It was found that bacterial aerosols may be set free by (a) a loose fitting cover, (b) lack of a gasket in a tight fitting cover, and (c) a worn bearing or loosely fastened drive shaft. Aerosols are also liberated during removal of blended materials from the bowls. A leakproof blender bowl has been developed and may be commercially available in the future (5, 16).

Aerosols formed by the process of decavitation during operation of the sonic oscillator

may escape through a loosely fitting cover when the contents are removed from the sump. Use of a larger size O-ring (No. 24) generally give adequate closure, while modification of the cover to allow for insertion of a rubber diaphragm so that the contents may be removed by syringe and needle, provides safe removal of contents. Due to the hazard involved, however, it is best to use a blender or a bacterial sonic disintegrator in a safety cabinet.

### *Clothing*

It is advisable to wear suitable laboratory clothing in infectious disease laboratories. The long-sleeve, operating gown which ties in the back and is worn over duck trousers is suitable for men, while a smock may be worn by women. A pair of shoes should be reserved for use in the laboratory only. Wearing a surgical cap may be desirable in animal rooms, when showers do not include the hair or when respiratory protective apparatus is used. Preferably, street clothing should not be worn beneath laboratory clothing, since the former may become contaminated if a spill occurs. Infection of laundry workers has proved that it is necessary to autoclave laboratory clothing of personnel working with some infectious agents (19).

Personal cleanliness is an important barrier to infection. Locker rooms should be equipped so that showers may be taken in case of accidental exposure to infectious materials or at the end of the working day. A germicidal soap containing Hexachlorophene is recommended.

### *Ventilation*

Except in congested areas and with highly infectious agents, sterilization of building exhaust air is of slight importance to the nearby nonbacteriological areas if air from the bacteriological safety cabinets is sterilized. Long experience with this installation has shown (a) that during weeks and months when the exhaust air sterilization system of the general laboratory building was accidentally inoperative (but the cabinet exhaust air was being sterilized), there was no infection of the laboratory personnel or of passers-by and (b) that it is extremely difficult to maintain consistently an air-flow

control such that no potentially contaminated room air escapes into an adjoining "clean area." Proper control of air at the immediate work site may reduce or eliminate the need for exhaust air filtration of the whole building. It should be pointed out that sometimes treatment of air is necessary for public relations or legal reasons. But for the technician, the most important source of infection is within 12 inches of his nose.

### Education

Equipping a laboratory with the finest safety devices does not insure against all possible laboratory infections. Equipment is no substitute for safe technique, which is based upon active participation by the worker at the laboratory bench in the process of establishing safe practices. All employees, new and old, should receive safety orientation and training. Supervisors and senior personnel must accept the responsibility for training new personnel and for insisting upon safe practices. A safety manual is an excellent medium for disseminating pertinent information. In our laboratories we have found that the establishment of a laboratory safety council has increased cooperation and facilitated an exchange of ideas. A tangible public award for a good safety record is always an incentive.

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- (B) Centrifuge angle head, International Equipment Co., Boston, Mass.
- (C) Micropipettor and pipettor, Alfred Bicknell Associates, Cambridge, Mass.
- (D) Micropipettor, Clay-Adams Co., New York, N. Y.
- (E) Micropipettor, A. S. Aloe Co., St. Louis, Mo.
- (F) Pipettor, Caulfield Safety Devices, Philadelphia, Pa.
- (G) Pipettor, Fisher-Scientific Co., Pittsburg, Pa.
- (H) Propipette, Selnaar and Co., Chicago, Ill.

# Changing the Priorities in Public Health

By GEORGE JAMES, M.D., M.P.H.

THE HEALTH OFFICER is often asked to describe his formula for starting new programs and getting rid of old unproductive ones. This chapter in the art of public health includes more than program development and is considered here under the broader heading, "Changing the Priorities in Public Health." During this era of rapid change in program content, health officers are forced to employ this art to an unusual degree. The present discussion is offered with the hope that some public health practitioners may be aided by statements that reduce their daily problems to simple generalizations which have "deductive fertility."

## Criteria for Determining a Priority

The establishment of priority is one of the major responsibilities of the health officer and provides tangible evidence of his capacity for leadership (1, 2). Before giving consideration to changing priorities, it would be well to list some of the criteria for establishing them.

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Those listed below are suggested in part by Ascher (3, 4) and are illustrated by examples from the public health field.

**Urgency.** There is no doubt that the health problems created by a smallpox outbreak or a flood deserve top priority. A breakdown in one of our major barriers against communicable disease, or a mass debacle of any kind, must receive our immediate attention.

**Feasibility.** Often a program could be readily undertaken with existing resources if a slight amount of effort were added. The teaching of self-breast palpation to middle-aged women by public health nurses can be given priority as part of each visit to a new family under the generalized public health nursing program. Similarly, the use of the tuberculosis mass chest X-ray survey for the detection of heart disease is another example of an extra dividend program.

**Scope.** Will the program be of benefit to a significant number of citizens or only a few? Will it be countywide or only of value to one small area? It is obvious, for example, that higher priority will be given to a health education program on the early signs of cancer than one on muscular dystrophy.

**Preparation for something more extensive.** Dr. Ascher calls this the "multiplier effect." Some communities have developed a mobile physiotherapy unit to give simple treatments to home-bound patients with arthritis. This is deemed worthy of priority, since it is probably the first step in a more elaborate program of home care and rehabilitation for all varieties of chronic illness.

**Coordination between existing programs.** Several communities have invested heavily in programs of slum clearance and construction of low cost housing. Health units in these

areas can gear their environmental sanitation activities to make the total program more effective. The health officer is often able to provide the cement which integrates the vital community programs of other agencies. Many examples of this can be found in existing air pollution, hospital planning, and mental health programs.

**Practicality.** This is the old concept of efficiency. When the expected return on a small program investment is very great, it becomes a practical matter to give that program a high priority. In this category one can place fluoridation of the public water supply, since at an annual cost of about 10 cents per capita a two-thirds reduction in dental caries among children can eventually be achieved. Another example is the allocation of official funds for the treatment of cases of ringworm of the scalp because of the far greater community cost of the uncontrolled spread of this disease among school children.

**Special ability or special mandate.** By virtue of its unique skill or legal powers the health department is often the only one or the one best able to perform a particular service. The collection, tabulation, and analysis of morbidity and mortality data, the performance of health services for school children, and the development of inservice medical care programs in municipal government have fallen to the lot of some health officers. It would usually be impossible for a community to develop effective programs in these fields should the health officer fail to give them priority.

**Good will.** The performance of adequate health programs requires a background of community good will and support. Practically every health officer has, on occasion, given high priority to programs of low health importance as a matter of sound public relations. To avoid later confusion, the health officer should openly admit that the chief objective of such a health program is the enhancement of good public relations if that is the fact.

### Changing the Priorities

The development of any health program requires attention to certain strategic factors in the community. With respect to any one pro-

gram, these factors are favorable or unfavorable to some degree. If entirely favorable, active service may begin immediately; if unfavorable, various subsidiary developmental steps must precede the large-scale program.

The physician who performed a "Smithwick" operation for the hypertensive disease of an influential State legislator was in a favorable position to promote a State hypertension commission. The availability of Federal funds for State industrial hygiene services during World War II resulted in the development of such divisions in the States that had not yet established them. Support for special case-finding programs among hospital admissions by local tuberculosis associations has sold these services to many communities.

The health officer who always waits patiently for the time when strategic factors become favorable can be said to be selecting his priorities on the basis of passive opportunism, that is, priority is given to something dramatic and successful, not necessarily that which is most needed to meet local problems. Such a health officer looks for and pounces upon the health angle of any general project that catches the community's fancy. This evokes that comparison between a statesman and a technician in public health (5), which may be applied to the opportunist. The opportunist in public health pursues fleeting, short-term, popular goals which are dramatic and sure of success; the statesman is not reluctant to lend his prestige to the struggle for those long-range goals which are greatly needed although temporarily neither popular nor feasible.

Lest one be tempted to develop a universal dislike for the public health opportunist, let him be advised quickly to correct that impression. Many of our excellent health programs in child health, medical rehabilitation, and research in chronic disease, owe their origin to a unique and happy combination of local factors. In fact, a health officer should be criticized for not taking advantage of such good fortune. Rather must the test of the practice of passive opportunism come from two other questions:

Having once seized the opportunity, has the health officer proceeded methodically and scientifically to build a firm and successful program, or has he dropped this one for the next fair



prospect which loomed into his jurisdictional field?

Is his total program a conglomerate of activities which arrived opportunely, or has he left his impact upon the field of public health practice through programs developed with a greater sense of his own responsibility for determination of priority?

The health officer of today expects to develop programs even when local strategic factors are not quite satisfactory. This chapter on the art of public health practice is the crux of our current task in the establishment of useful programs against the chronic degenerative diseases and accidents. Several examples will be considered to illustrate how priorities can be changed in the absence of perfection in local strategic factors.

**The active opportunist.** A health officer can act the opportunist even if there are no current opportunities. This might be dubbed "the program plan approach." This health officer sets many irons in the fire. When one of them gets hot, he steps in quickly and forges his program along the lines already planned. Instead of forcing a public reaction, the health officer needs merely wait for public opinion to force the program, which will be any of those he has been holding in readiness.

The danger of such an approach is, of course, that full many an excellent program may be "born to blush unseen." The health literature is replete with excellent program plans which read well but recount only an idea, not a blueprint for action which was effectively taken. After all, how does one judge a program plan which has never been translated into action?

Again, let the reader be assured that there need be no invidiousness attached to this technique of changing priorities. In fact, it is to be highly recommended for those programs which reason tells us are due for the touch of Midas. Health officers would do well to plan thoroughly in the field of adult rehabilitation, home care, radiological health, and mental health. Yet, once having planned, should we not do something more with our script than file it away until D-Day? If not, is there not the distinct danger that some other agency, presumably less well qualified than the trained health department, will seize the initiative be-

cause it happens to be more available to certain newly developing strategic factors?

**The demonstration.** Long an honored approach to the changing of priorities, the demonstration is usually characterized by its heavy accent on quality service. Less well recognized is the fact that the demonstration should be used only when the health officer is sure of his scientific and practical grounds. A demonstration, it should be remembered, can also be taken by our critics as proof that something cannot be done.

In developing the project, care should be taken to bite off no more than can be thoroughly chewed. If you are planning a complete and integrated school health demonstration program, do not try to establish it in your entire district. One census tract, one school, or even one classroom may be all you can handle effectively without compromising quality. The demonstration team must be overstaffed; later on is time enough to prove we can do the job or the major part of the job with less expense and personnel. Public relations skill is required and care must be exercised. The population involved can learn to consider themselves unhappily as guinea pigs, or with good public education, as those fortunate few who are privileged to receive the first chance to participate in an excellent program.

The demonstration approach is useful today for diabetes detection programs, heart disease detection by mass survey, prophylactic treatment of cases of rheumatic fever, and tumor diagnostic clinics. It, perhaps, should not yet be used for obesity control, which still seems to be based upon too much scientific conjecture to be predictable.

**The research approach.** The research project differs from the demonstration in one major respect: Its scientific basis is not yet considered proved. In fact, the central idea of establishing the project is to discover more scientific evidence, although it may also render good service to the study population. Our welfare colleagues have coined the term "service-linked research" as a fitting description of this method of program development (6).

The Albany Cardiovascular Health Center (7, 8) is a good example of this technique of changing priorities. The State civil service's



male population between the ages of 40 and 54 are receiving a complete periodic cardiovascular evaluation under a project established by the New York State Department of Health. Not only is this project stimulating fundamental research among the team who are members of the staff of the Albany Medical College or the State Health Department, but it is also aimed at:

- Evaluating the validity and reliability of techniques for the early diagnosis of coronary heart disease and hypertension.

- Stimulating an interest in heart disease among the staff of this State health department and encouraging them to add heart disease studies and related projects to their own specific programs.

- Giving the best in heart disease detection services to a "susceptible" population.

Similar projects are under way with respect to the study of highway accidents (9), prevention of first attacks of rheumatic fever among school children (10), and home accidents (11) in certain areas. At times this technique is used to iron out the administrative features of a program based upon fairly sound scientific principles. The term, pilot project, is commonly, but not exclusively, associated with this use. Such projects do not necessarily require the firm scientific base of a demonstration project.

**The get-ready approach.** Realizing that he wishes to reach a distant, still unattainable goal, the health officer may undertake a minor program which has a great multiplier effect. This brings him much nearer to coming to grips with the major problem.

In New York State, a program of control of shoe-fitting fluoroscopes was used as the first step in a complete program in radiological health (12). Noting the increasing scope of the problem of ionizing radiation, the department found that the relatively simple task of surveying and correcting the defective units among its 400 shoe-fitting fluoroscopes gave it the opportunity to:

- Acquire much data on the practical risks of ionizing radiation.

- Obtain equipment needed for radiological surveys.

- Stimulate citizen and staff interest in the problem.

- Develop inservice training, both academic and practical, for local health officers and sanitary engineers.

- Develop an extensive program plan, get additional staff, and obtain passage of a complete sanitary code chapter on radiological health.

**The advisory committee.** A problem such as radiological health, which touches many highly skilled professions, should be approached with the most expert advice. The available data must not only be accurate; it must be correctly interpreted. The implications of various control procedures must be appreciated and endorsed by the technical groups which are concerned. An advisory committee of leaders in these fields is essential.

The use of an advisory committee implies certain specific cautions over and beyond the obvious one of obtaining the proper personnel to serve:

- Do as much work as you can before they convene. You cannot afford false starts. These are usually busy people who cannot take the time to teach you fundamentals. Study the field well, send someone away for a special course if it is unfamiliar, and consult in advance with a key member of the committee to be sure you are on the right track.

- Send the material to be considered to each member well in advance, indicating your sources of information, and if possible, areas of special discussion and decision.

- If the group changes the first draft materially be sure that each has an opportunity to review and comment on the final draft.

The technique of the advisory committee has worked unusually well with new programs based upon the self-policing of special groups. Besides its use in radiological health, a State has found it of value in developing a program involving the labeling of household products which may be hazardous if improperly used (13). It has had an excellent trial in several areas for the development of programs of disaster control. Some health departments are now adopting the plan as a practical step toward good public relations in administration by having advisory committees of prominent citizens help define community needs and promote solutions.

**The joint approach.** Often a health officer can accomplish much by coordinating his efforts with those of another agency. His added increment of resources, though slight, may be precisely what is needed to make a worthwhile program a reality. At present, it is possible to work with cancer societies for the development of cancer registers, to tie diabetes surveys in with tuberculosis society mass X-ray programs, and to engage in rheumatic fever prophylaxis programs with heart associations.

In the use of this technique, the health officer is urged to spell out the details of the arrangement in writing. Such problems as the duration of the program, the extent of its evaluation, the next steps, the implications to other programs, are well worth some thought in advance. No health officer should permit his complete program to bog down due to firm, long-range commitments made to so many agencies that he has ended by relinquishing all rights to the determination of priority.

**The advance on many fronts.** Some health officers like to establish a balanced program of new activities; they insist upon having some entry that can be made under each category of public health activity. When something new arises, they do something about it, even if it is on a small scale. This is not a demonstration, not a well-planned approach, not research, not a pilot project, merely something to permit him to dabble lightly in a large variety of services.

If one mentions adult rehabilitation, this health officer reminds us that his public health nurses are following and attempting to return a few hemiplegics to self-sufficiency. If we bring up multiple screening, he has done some hemoglobin and diabetes tests at a county fair. If we mention home accidents, he had his statistician make a 2-month tabulation of patients treated at the emergency room of the local hospital and had a public health nurse follow up on a few of them.

Such public health dilettantism is not necessarily bad. It can be a good first step toward something better and, when this occurs, leads to the concept that there are really no new programs in public health, only changes in emphasis. Best of all, it is often the only way to cajole a reluctant staff. You can sell the care of Mrs. Fred Smith to a nursing division too

busy to accept a "program" in adult rehabilitation. You can get a sanitarian to check the lighting in an apartment hallway when the explanation of your plans for a sanitation home-accident program falls on deaf ears. Using this oblique approach, one can get a community to accept a worthwhile cancer program even before it realizes that something new had been added.

### Unloading the Old Program

Since there are, to put it mildly, limitations to the resources available to local health officers, the addition of new programs means that "something's got to give." Health officers fear, and rightly so, to end programs precipitously. Such action may lead to a general feeling of impermanence and consequent lack of fervid local support toward public health programs. Nevertheless, old programs can be dropped under one of several methods:

**Changing the character or purpose.** The mass chest X-ray for tuberculosis will probably be used increasingly for heart disease and lung cancer detection while its original purpose declines in importance. The female clientele of a venereal disease clinic are easily available for cancer detection, particularly advisable since syphilis (14) and neglected cervicitis (15) are both considered to be precancerous lesions.

**The knife.** The development of modern knowledge about communicable disease control has permitted drastic changes in quarantine regulations and the free distribution of certain antitoxic serums. Occasionally, when available funds have been curtailed, health officers have found it feasible to do this (16).

**Demonstration in reverse.** A real challenge awaits local health officers who would like to explore methods of streamlining some of our traditional health programs. Evaluation studies on the details of pasteurized milk inspection, water and sewage plant inspections, and some of the routines of school health practice might prove that much current effort could be curtailed. Perhaps better, quick-screening techniques could be employed to give warning of those places or persons requiring detailed individual attention. Such demonstration in reverse, in the sense that it shows how the efficiency of our programs may be improved by

curtailment, should result in the saving of effort which can then be diverted to more valuable services.

**Plus-minus method.** This method can also be called "accentuating the positive." By so doing, attention is drawn away from the unnecessary so that it can be de-emphasized. In milk-production control, one can accent cooling, clean equipment, and cow health, and allow cracks on the floor, area of window space, and certain required partitions to acquire less significance. Greater attention in cancer control can be given in some areas to teaching individual physicians how to perform cancer diagnosis rather than continue to multiply the number of expensive cancer detection clinics. In school health, the development of strong programs of teacher-nurse-parent conferences will draw attention away from unproductive, routine morning clinics.

**Gradual attrition.** Old programs which refuse to die might eventually fade away. County health units which have practiced rigid quarantine for certain common communicable diseases may hesitate to suggest a drastic change in keeping with modern control regulations. There is always the fear that any de-emphasis in control may spread to other disease programs. By avoiding all attempts at stimulating this particular program it can slowly wither until the community is better prepared to take a definite stand at modernizing quarantine regulations.

### Summary and Conclusion

This discussion seeks to explore a small chapter in the art of public health practice dealing with the ways in which health officers add new services to their entire community health programs. Some of the criteria for the determination of priority are listed and certain principles presented to indicate how these priorities are changed. Examples of the development of new programs and de-emphasis of others are discussed. In general, we require two things of the modern health officer:

- Many individual approaches to public health practice.
- Precise and adequate communication on the plans and results of these practices.

From the mutual stimulation following the

defense of his activities before a jury of his peers will come progress not only in the science of preventive medicine but in the health officer's own very special art of public health practice.

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## Jones Criteria (Modified) for Guidance in the Diagnosis of Rheumatic Fever

**R**HEUMATIC FEVER is related to previous infection with group A beta hemolytic streptococcus, but the mechanism of the disease is unknown. Its boundaries are indefinite, and its differentiation from other diseases is sometimes impossible. There is no specific laboratory diagnostic test. The diagnosis must therefore be arbitrary and empirical. Criteria herein set forth are aimed at identifying those individuals who have had or are having an attack of rheumatic fever. They make no attempt to measure rheumatic activity at any given time or to diagnose inactive rheumatic heart disease. Thus, following the designation of an illness as rheumatic fever, the existence of continued activity or the presence of inactive rheumatic heart disease may be indicated by criteria different from those outlined below.

Criteria are necessary in order to minimize both overdiagnosis and underdiagnosis. The tendency to label as rheumatic fever a chronic febrile illness for which no obvious cause can be found is to be deplored. The tragedy which may lie in the wake of the false diagnosis of rheumatic fever may be even greater than the possible harm of missed recognition in questionable cases. The institution of effective

prophylactic regimens requiring prolonged administration of sulfadiazine or antibiotic agents places a grave responsibility on the physician in the diagnosis of this illness.

In this statement, the diagnostic features of the disease are divided as originally proposed by Jones into major and minor categories dependent upon their relative occurrence in rheumatic fever and in other disease syndromes from which this disease must be differentiated. Thus chorea is included among the major criteria while fever, a symptom common to many diseases, is placed in a minor category. These major and minor categories have no significance beyond their diagnostic import either as to prognosis, amount of "rheumatic activity," or severity of acute illness. Indeed, a severe manifestation of rheumatic fever such as rheumatic pneumonia is not included because it is difficult to differentiate from congestive cardiac failure and because it almost always occurs in patients whose rheumatic fever is so obvious as to offer no difficulty in diagnosis.

The presence of two major criteria or one major and two minor criteria indicates a high probability of the presence of rheumatic fever with one notable exception (see "other manifestations"). In addition to the major and minor criteria to be used in the recommended formula, other manifestations have been listed which may be used to support the diagnosis. These criteria are not meant to substitute for the wisdom and judgment of the clinician. They are designed only to guide him toward a diagnosis of the disease with the suggestion that he follow carefully all questionable cases and restrict the diagnosis of rheumatic fever to illnesses which meet acceptable criteria.

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*This report of the Committee on Standards and Criteria for Programs of Care of the Council on Rheumatic Fever and Congenital Heart Disease of the American Heart Association has been approved by the executive committee of that council. The original report was published in "Modern Concepts of Cardiovascular Disease," vol. 24, September 1955. In revised form, it is being given wide circulation to support efforts to detect and treat rheumatic fever.*

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## Major Diagnostic Criteria

### Carditis

**Murmurs.** The presence of a significant apical systolic murmur, apical mid-diastolic murmur, or basal diastolic murmur in an individual without a history of previous rheumatic fever or in whom there is good reason to believe there was no pre-existing rheumatic heart disease; or a change in the character of any of these murmurs under observation in an individual with a history of rheumatic fever or rheumatic heart disease.

**Increasing Cardiac Enlargement.** Obviously increasing cardiac enlargement by X-ray.

**Pericarditis.** Pericarditis manifested by a friction rub, pericardial effusion, or definite electrocardiographic evidence.

**Congestive Failure.** Congestive heart failure (in a child or young adult under 25) in the absence of other causes.

### Polyarthritis

Polyarthritis tends to be migratory and is manifested by pain and limitation of active motion, or by tenderness, heat, redness or swelling of two or more joints. Arthralgia alone without objective evidence of joint involvement is not a major manifestation.

### Chorea

This must be differentiated from habit spasm, athetosis, and cerebellar ataxia. Movements must be characteristic, involuntary and of moderate severity if chorea is to be used as a major manifestation.

### Subcutaneous Nodules

These are shot-like, hard bodies seen or felt over the extensor surface of certain joints, particularly elbows, knees and wrists, in the occipital region, or over the spinous processes of the thoracic and lumbar vertebrae.

### Erythema Marginatum

This recurrent, pink, characteristic rash of rheumatic fever, in which the color gradually fades away from its sharp scalloped edge, is found mainly over the trunk, sometimes on the extremities, but not on the face. It is transient, is brought out by heat and migrates from place to place.

## Background

In 1944, the late Dr. T. Duckett Jones published criteria for the diagnosis of rheumatic fever which have been generally accepted in the United States and in many parts of the world. Subsequently Dr. Jones guided the revision of his criteria for use in the United Kingdom-United States Cooperative Study on "The Relative Effectiveness of ACTH, Cortisone and Aspirin in the Treatment of Rheumatic Fever," and, just prior to his death, he participated in a conference on the revision of his original suggestions for use by the practicing physician. These modified Jones criteria are based in great measure upon his suggestions.

## Minor Diagnostic Criteria

### Fever

A significant rise in temperature is a common symptom, but, because it occurs in so many illnesses, it has little differential diagnostic value. In order to be included, the elevation in temperature must clearly exceed the normal diurnal fluctuation in which there is great individual variation.

### Arthralgia

Pain clearly located without objective findings is only a minor criterion for diagnosis. The pain must be in the joint, not in the muscles or other periarticular tissues, and must be distinguished from the nocturnal pain in the extremities occurring in normal children. Arthralgia must not be used as a minor criterion when polyarthritis is included as a major criterion.

### Prolonged P-R Interval in the Electrocardiogram

Prolongation of the P-R interval may be nonspecific; it is considered a minor criterion and is not diagnostic of carditis. It cannot be used if carditis is already included as a major manifestation.

### Increased Erythrocyte Sedimentation Rate, Presence of C-Reactive Protein, or Leukocytosis

Elevation in one or more of these nonspecific tests may be considered as a single minor cri-

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## NATIONAL HEALTH FORUM

# chronic illness

**T**HE National Health Forum is conducted each year by the National Health Council to consider a currently pressing health problem. This year the problem was the mounting "daily disaster" of chronic illness.

Because of the wide concern over the magnitude of chronic illness, 800 health leaders attended the 2-day session of the forum in New York City, March 21 and 22, 1956. They came from the 50 national organizations which are the active, advisory, associate, and sustaining members of the National Health Council, from 35 additional national organizations, and from many State and local groups.

Forum participants heard Leonard W. Mayo, chairman of the Commission on Chronic Illness and director of the Association for the Aid of Crippled Children, in the keynote address, say that chronic diseases account for 88 percent of all disabling conditions in the United States.

Chief speaker at the closing dinner, March 22, was Dr. Lowell T. Coggeshall, recently appointed Assistant Secretary for Health and Medical Affairs, Department of Health, Education, and Welfare.

The address of Mr. Mayo on the problem and the challenge of chronic illness, and Dr. Coggeshall's answers to the challenge plus seven other papers from the forum are presented in brief on the following pages.

"Chronic illness accounts for almost three-fourths of the Nation's daily sickness toll," said President Dwight D. Eisenhower in a telegram read at the opening session by Hugh R. Leavell, M.D., president of the National Health Council. The President's message continued:

"There is urgent need both for more research into such disease and for prompt and widespread application of existing knowledge. For their continuing effort to solve this health problem of vital concern to our Nation, I congratulate the agencies represented in the National Health Council."

In an introductory speech, the chairman of the forum, Theodore G. Klumpp, M.D., who is president of Winthrop Laboratories, described the forum as essentially an effort to discover the type of "gears" needed to meet the new health care demands created by the predominance of chronic illness and how best to "shift" into them. He said the forum's task lay in the realm of human engineering.

"People and institutions are finding it hard to shift gears fast enough to keep pace with the changes that new scientific discoveries are making in the methods by which we may preserve or regain health among people of all ages," he stated.

terion. Particularly to be deplored is the tendency to use any of these tests as a major criterion or as diagnostic of rheumatic fever. There are many other nonspecific tests, but these three are most commonly used.

#### **Evidence of Preceding Beta Hemolytic Streptococcal Infection**

This must be documented by (1) a history of scarlet fever or by a typical clinical picture of other streptococcal infection preceding the onset of rheumatic fever by one week to one month, the nature of the infection being confirmed by a history of immediate contact with other individuals having typical streptococcal infection or by positive culture of the nose or throat in which beta hemolytic streptococcus predominates; or (2) an elevated or rising anti-streptolysin-O titer.

#### **Previous History of Rheumatic Fever or the Presence of Inactive Rheumatic Heart Disease**

The existence of either of these may be used as a minor criterion to aid in deciding the rheumatic nature of the illness in question. For this use, the previous history must be documented by the same objective criteria as are set forth in this statement or by the presence of inactive rheumatic heart disease.

### **Other Manifestations**

These include systemic manifestations such as loss of weight, easy fatigability, elevated sleeping pulse rate (tachycardia out of proportion to fever), malaise, sweating, pallor or anemia, and local manifestations such as epis-taxis, erythema nodosum, precordial pain, abdominal pain, headache, and vomiting. These, as well as a family history of rheumatic fever, provide additional evidence of the presence of rheumatic fever but are not to be included as diagnostic criteria.

There are combinations of these diagnostic criteria which occur in the presence of other illnesses which must be ruled out before a definitive diagnosis is made. One combination in particular—polyarthritides, fever, and elevated sedimentation rate—is the weakest of all combinations of major and minor criteria. Diseases to be ruled out include rheumatoid arthritis,

gonococcal arthritis, lupus erythematosus disseminatus, subacute bacterial endocarditis, non-specific pericarditis with effusion, leukemia, sickle cell anemia, serum sickness (including manifestations of penicillin sensitivity), tuberculosis, poliomyelitis, undulant fever, and septice-mias, particularly meningococcemia.

### **Murmurs Indicating Carditis**

#### **Significant Apical Systolic Murmur**

A significant apical systolic murmur is long, filling most of systole; is heard best at the apex; is as well transmitted toward the axilla as over the precordium; and does not change with position or respiration. It must be differentiated from an innocent (functional) murmur which is frequently found in normal people. This innocent murmur is systolic, occasionally harsh, is heard best along the left sternal border and usually changes with position and respiration. Borderline systolic murmurs, intermediate in location and nature, occur and should be carefully watched. Questionable murmurs which are intermittently present or which, after a period of observation, cannot be clearly classified as significant are rarely of any import.

#### **Apical Mid-Diastolic Murmur**

A significant organic apical systolic murmur is frequently accompanied by a low-pitched, short mid-diastolic murmur which is sharply localized to the chest wall over the apex of the heart and often heard best with a patient in the left lateral position with the breath held in expiration. This murmur, rarely present in the absence of an apical systolic murmur, confirms the significant nature of the latter. It must be differentiated from the long, low-pitched, crescendo apical presystolic murmur followed by an accentuated mitral first sound which is indicative of mitral stenosis but not of acute carditis.

#### **Basal Diastolic Murmur**

The development of a basal diastolic murmur of aortic insufficiency is also indicative of carditis. It is an early, short, diminuendo murmur usually heard only or heard best along the left sternal border in deep expiration. It has great diagnostic value, even though it may be difficult to hear and present only intermittently.



of these experiences are distilled in the following statements:

- A study of community chronic illness can be an instrument to effective action, but if not wisely planned, it can prove to be an obstacle.

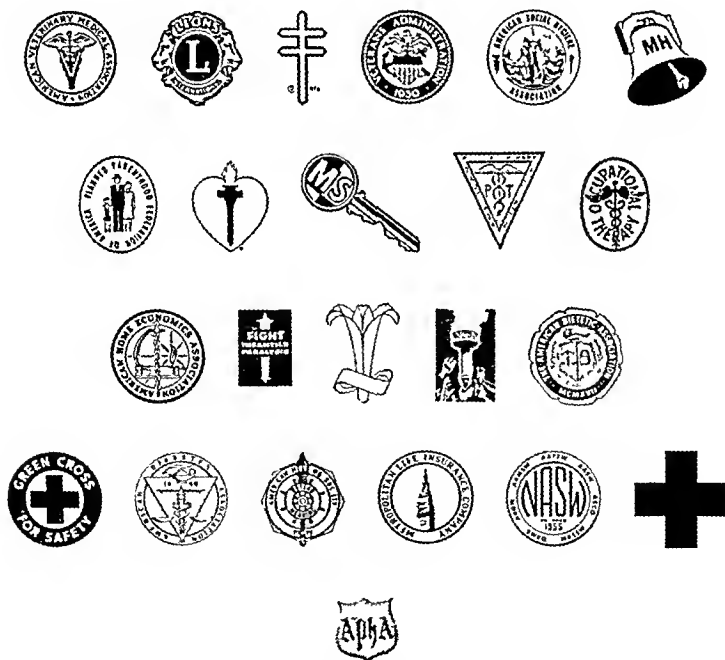
- Participation of physicians in any community program for the chronically ill is of key importance.

- People who cannot understand vague references to "the chronically ill" will listen to specifics; for example, "Mrs. Brown is taking Hope Hospital's homemaker service to old Mr. Attarian each day."

Other panel moderators were Arnold B. Kurlander, M.D., chief, Chronic Disease Program, Public Health Service; Cecil G. Sheps, M.D.,

executive director, Beth Israel Hospital, Boston; George Bugbee, president, Health Information Foundation; G. D. Carlyle Thompson, M.D., executive officer, Montana State Board of Health; and Leona Baumgartner, M.D., New York City health commissioner and incoming president of the National Health Council.

Next year's forum will consider mental health, in its broad implications for all organized health effort. To be held in Cincinnati, March 20-21, it is part of a plan to rotate the annual forums of the council throughout different areas of the United States. Basil O'Connor, president of the National Foundation for Infantile Paralysis, was chosen president-elect of the council.



Symbols of some of the participating organizations of the National Health Council.

"We do not wish to discard any of our human and institutional health care machinery, for we have too little of both, but rather to think of retooling and reassembling where changes may do the most good," he said.

Dr. Klumpp cited estimates of the Commission on Chronic Illness, indicating that 28 million persons in the United States—1 in every 6—suffer from some known physical or mental impairment.

More progress has been made in the conquest of disease and the prolongation of life in the last 50 years than had been accomplished in 999 centuries of man's previous existence, Dr. Klumpp said. Life expectancy has moved upward from 49 years in 1900 to almost 70 years in 1955, and, if the population forecast is correct, he continued, 1 in every 7 persons in 1980 will be 65 years of age or older.

"That means a larger burden of the chronic illnesses, though we shall hope that new medical and surgical advances can cut down the toll," he stated.

"Dealing with the long-term illnesses requires a great deal more community cooperation and more individual initiative and understanding than it took to control the communicable diseases," Dr. Klumpp pointed out.

Recommendations for the retooling which Dr. Klumpp urged were numerous throughout the six panel discussions that made up the major part of the forum. One of the panels sought answers to whether a home care program should be hospital oriented or health department oriented, how much responsibility for the chronically ill the general hospital should assume, how the necessary integration of hospital and home care can be realized.

Two other discussion questions were: Can the total of voluntary (direct and prepaid) and public assistance payments be increased to reduce the balance of unmet needs, with all that they entail of individual suffering and human waste? How can we awaken communities to chronic illness needs? Through service and referral centers? Through studies? Through committee action?

Four priorities seemed to emerge from the

many needs for action on chronic illness brought out in the panel sessions. These may be stated as:

1. Adopting a "do it yourself" approach to health problems in order that all citizens may seek medical aid in the early detection of chronic diseases and cooperate in whatever changeover is required in each community to meet the new challenges presented by long-term diseases and disabilities.

2. Joining more closely the medical and social sciences since the effective medical care of the patient and his cooperation are to be realized only through good community organization.

3. Providing tools to help professionals and the general public understand more acutely the common denominator aspects of chronic illness so that community health services may develop the flexibility and flow requisite to care of the chronically ill.

4. Taking inventory of the sickness in the Nation and what is needed in the way of additional services and planning.

Samples of the forum's advice may be drawn from the experiences reported to the panel on "Community Action Together." The panel was moderated by Charles H. Brasuell, executive director, Pennsylvania Health Council. Three

### Coordination of Communication

In the hope of encouraging speakers to say what they really mean, rather than repeat ritualistic phrases or shopworn words which have lost their original market value, one panel agreed that a fine would be levied for what James Thurber has satirized as "the gongrenous repetition of threadbarisms." Specified examples included "cooperote," "integrate," and "coordinate," as well as "area" and "level of action." Fines ranged from 5 cents for abuse of "impact" and 10 cents for "field" to 25 cents for "in terms of." The fine for "integration into the basic health structure" was remitted for a speaker who used the phrase at the right point. Panel members so well voiced their thoughts that receipts were zero.

and enhanced by the presence in the community of adequate treatment facilities. Hospitals, clinics, nursing homes of high standard, and like facilities come only as the direct result of citizen interest and community action.

Of the nearly 5.5 million victims of long-term illness, 2.1 million are 65 years old and over, 1.8 million are between 45 and 65, and 1.4 million are under 45. These figures and the record of the rehabilitation of chronically ill persons should put to rest the common misconception that chronic illness is synonymous with old age and generally incurable. The rate of chronic illness in relation to age is, however, significant. It is 1.3 percent for those under 45, 5.8 percent for those between 45 and 64, and 17.1 percent for those 64 years old and older. Disabling illness is 13 times as great for those 65 years of age and beyond as it is for those under 45.

### Principles and Recommendations

The Commission on Chronic Illness has evolved a number of basic principles and a series of recommendations as a result of important studies, fact finding surveys, and research. It is both timely and appropriate to list a few of the most germane.

First, as to the individual patient himself—his needs, his rights, his personality are paramount. His needs cannot be met, nor his rights properly recognized, nor his personality fully respected, however, unless he is treated as a whole person. If he is regarded thus, his rehabilitation or restoration will inevitably include the services of many professions and disciplines.

When more than one profession is involved, there arises the need for wise planning, skillful cooperation, and harmonious interplay among the representatives of each profession. This is, in essence, the team, currently a popular concept but not yet fully understood or too effectively practiced.

In this integrated approach to the treatment of chronic illness, perhaps the strongest factor is our knowledge and treatment of the purely

physical aspects, and the weakest is that of the social and emotional factors. We have considerable security in dealing with the former, but something less than that in dealing with the latter.

Recognition should therefore be given to the importance of the emotional attitude of patients whose illnesses become long drawn out, permanently crippling, or in other ways a major frustration. These attitudes embrace morale, motivation, and mood. Personnel in institutions, in the home, and the patient's family must constantly seek to help the patient endure pain, delay, and disappointment; faithfully follow difficult treatment regimens; keep hope alive; maintain a will to live; and develop a philosophy of acceptance as part of a mature faith.

Care of the chronically ill is inseparable from general medical care. While it presents certain special aspects, it cannot be medically isolated without running serious dangers of deterioration of quality of care and medical stagnation.

Care and prevention are inseparable. The basic approach to chronic disease must be preventive, and prevention is inherent in adequate care of long-term patients.

Rehabilitation is an innate element of adequate care, and the process properly begins with diagnosis. Rehabilitation is applicable alike to persons who may become employable and to those whose only realistic hope may be a higher level of self-care. Not only must formal rehabilitation services be supplied as needed, but programs, institutions, and personnel must be aggressively rehabilitation-minded.

With full appreciation of the necessity for adequate institutional facilities, and with the realization that some areas lacking in such accommodations should provide them, the commission feels that henceforth communities generally should place the greater emphasis on planning for care in and around the home.

Hospitals, outpatient departments, health departments, nursing organizations, and others furnishing the specialized services required by the long-term patient should reexamine their policies and practices to assure for him the best modern medical care.

# Five Million People



Chronic illness is the challenge of this era to hospital, public health, medical, nursing, and all the professional services concerned with sickness and disability. It is a golden opportunity in the golden age of medicine.

The challenge of chronic illness is seen in the lives of all those who are adversely affected physically, socially, and economically, and particularly in the lives of the estimated 2 million adults who, though now idle, could become employable and tax paying if provision were made for their rehabilitation. More than 90 percent of these persons could be brought to complete economic self-sufficiency if adequate facilities for rehabilitation were available to them. The Office of Vocational Rehabilitation of the Department of Health, Education, and Welfare has an extended program with this objective in mind.

The problem of chronic illness—much better defined as long-term illness—is illustrated by the hard core of nearly 5½ million people in the United States with chronic disabilities sufficiently serious to require some form of care. It is illustrated daily by the continuing struggle maintained at an appalling cost in dollars, depleted energy, and lives against the cardiovascular diseases, responsible for more than half of the deaths in the country; against cancer, which kills a quarter of a million Americans annually; against mental illness, which brings three-quarters of a million people under

some form of hospital care in the course every 12 months; against arthritis and rheumatism; against blindness and deafness; against epilepsy, tuberculosis, multiple sclerosis, Parkinson's disease, diabetes, cerebral palsy, and various eye disorders. In short, these diseases and handicaps account for 88 percent of all disabling conditions in the United States.

## Commission on Chronic Illness

The Commission on Chronic Illness, composed of nearly 50 interested and knowledgeable citizens and some 30 technical assistants, and served by a highly competent staff, was founded in 1950 by the American Medical Association, the American Hospital Association, the American Public Health Association, and the American Public Welfare Association to help define, identify, clarify, and classify the problem of chronic illness.

The commission has defined chronic illness as comprising "all impairments or deviations from normal which have one or more of the following characteristics: are permanent, leave residual disability, are caused by nonreversible pathological alterations, require special training of the patient for rehabilitation, may be expected to require a long period of supervision, observation or care."

The commission was dissolved in June 1956. It therefore remains for other organizations to go forward with extensive programs designed to meet the problems of chronic illness.

—LEONARD W. MAYO

*By Leonard W. Mayo, chairman of the Commission on Chronic Illness and director of the Association for the Aid of Crippled Children, New York City, who summarizes in brief the principles and recommendations of the commission, to be published soon in a four-volume edition. A midway report on the work of the commission appeared in the March 1954 issue of Public Health Reports, p. 295.*

Chronic illness is no longer the exclusive and private business of the patient and the healing professions. It is a matter of public concern in an age when, for humanitarian reasons and for reasons of defense, the Nation is more conscious than ever before of the need for conserving human resources. In such an age, illness, disability, and preventable death are problems the whole community must comprehend and help solve. The time-honored confidential relationship between the physician and his patient has limited value unless it is supported

of various types of existing resources for care.

- List the kinds of needs represented in a cross section of the people in the town or county who have been ill or handicapped for a period of time—medical, educational, vocational, social needs, and the like—and the kinds of services, facilities, and personnel required to meet such needs somewhere near adequately.

- Determine how a unified program to meet the needs should be financed and administered.

The services and facilities that a typical town or county should expect to develop in about 10 years might be something like the following checklist. It can be adapted to any size community.

*A diagnostic, evaluation, and classification center.* The center should be located in a hospital if at all possible and should sustain close relations with all hospitals in the area. With the cooperation of the private physicians and hospitals who refer cases to it, the center should provide full diagnostic and evaluation service for the chronically ill and the handicapped.

*Counseling and employment service.* The service should probably be a part of the diagnostic and evaluation center, though it would be closely related to the board of education and the council of social agencies as well. It would furnish educational, vocational, and employment guidance.

*Treatment facilities and services.* Every county should have at least the following facilities and services for the benefit of all chronic patients residing in the area.

1. Medical and dental societies interested in the problem of the chronically ill.

2. Adequate public departments of health and hospitals.

3. A program of home care (many chronic patients now in hospitals and nursing homes can be cared for at home with the aid of housekeeper service, public health nurses, and hospital personnel).

4. Licensed nursing homes under public or private auspices or under both and closely related to the hospitals.

5. A private or county hospital or a wing

exclusively for chronic patients requiring hospital care for a protracted period.

6. Home industries and educational programs for persons who can carry on a limited amount of work or study at home.

7. Sheltered workshops and special educational classes for adults, children, and young people who cannot meet the demands of regular employment or school.

Along with these services and facilities, there should be sufficient flexibility and fluidity so that a patient may move from one service to another as his condition changes. Thus, a patient might be referred to the diagnosis and evaluation center, be sent to the hospital for the chronically ill, move on to a nursing home if his condition so indicates, go later to his own home, thence to a sheltered workshop, and finally to regular employment if rehabilitation is relatively complete.

It is this dynamic element or movement quite as much as the accession of needed services and facilities that will mark the community and hospital efforts of the next decade as differing from those we have known.

The costs of such a program will not be entirely met by salvaged lives and earning capacities, and by the elimination of duplicating and unnecessary services. Yet, in due course, citizens will find that under a modern dynamic program the number of persons rehabilitated and returned to full or partial employment will go a long way, over a period of time, toward meeting the extra cost.

The words of Thomas Mann suggest the philosophy that should guide us: "Let us think like men of action, let us act like thoughtful men."

## Public Programs



The challenge and the problem of chronic disease and disability concern the entire Department of Health, Education, and Welfare—involving to some extent the Social Security Administration, the Office of Education, the

Adequate care of the long-term patient requires arrangements which promote frequent evaluation of the patient's needs and easy flow back and forth among home, hospital, and related institutions.

Coordination and integration of services and facilities are a must in promoting good care for the chronically ill.

No pattern for organizing services is satisfactory for all communities. Programs must of necessity be tailored to fit local situations, taking full account of what is good in existing resources for care at home or in an institution. Planning should be based on facts—both local and regional—as to needs, density of population, financial capacity, and types of illnesses and accidents likely to prevail.

Planning and programs must be directed to the needs of all long-term patients, and not limited to the needs of any special economic, racial, cultural, or other segment of the population.

Personnel shortages in the professions concerned with the chronically ill constitute a major block to improvement of care. The number of personnel must be increased by recruitment, assistance with the costs of education, attractive salaries, and other inducements. This is particularly applicable to personnel associated with physicians in patient care.

The cost of programs to provide care to long-term patients should be measured first as to human values of effectiveness, then as to productivity. The most economical care is that which returns a person as quickly and as fully as possible to the highest attainable state of health and social effectiveness.

The primary function of philanthropy in financing long-term care should continue to be that of strategic investment of venture capital. Philanthropy should play an important role in financing the coordination of community facilities and should lead the way in the provision of more adequate care through research, demonstration, and experimentation.

Public financing of medical care for long-term indigent and medically indigent patients is inadequate in most communities, whether for long-term or short-term general hospital care, mental and tuberculosis hospital care, nursing-

home care, rehabilitation services, or care at home.

Increased amounts of public and private funds must be devoted to measures to coordinate the services needed by long-term patients.

Private and public expenditures for research should be expanded.

A vigorous program of public education should be launched to stimulate the achievement of the recommendations for financing outlined herewith.

Investigations of diseases and their origins and studies of the needs and responses for maintaining and improving health should command high priority in the spending of research funds. To increase and extend the application of knowledge gained from research, laboratory and clinical investigations must be correlated with intensive and extensive research designed to measure the dimensions of the chronic disease problem and to reveal the most appropriate and effective methods and procedures for meeting those problems.

#### Checklist for Any Locality

The effective application of these principles, policies, and philosophy to local communities is basic to meeting the challenge of chronic illness in the United States. An area of 100,000 population, for example, may expect to have 3,500 persons needing long-term care. More than three-fourths of these persons are in their own homes, yet they may need some form of help from a community service at some time.

If a community does not have a committee now studying problems of chronic illnesses as a whole, such a committee should be organized. It could be set up on a town or county basis. It should be composed of both professional health leaders and representatives of other professions as well as business, industry, and labor. It should be developed in cooperation with medical and dental societies, the council of social agencies, the health council, and the health department. Three first steps for such a committee would be to:

- Study the total problem of chronic illness in the area and, with the help of a small staff, bring together facts on the extent and character

physical plant now used for medical research was designed or built at the beginning of the century. It is not satisfactory for modern health research.

Even if unlimited sums were suddenly made available for medical research, and satisfactory physical facilities existed in which to conduct expanded research, I doubt that progress could be accelerated in the face of a shortage of adequately trained, properly paid, young people. Too many talented young men and women in the health professions leave teaching assignments, research laboratories, health departments, and hospitals because of financial pressures. Of course, we all recognize that dedication is a prime requisite for a health practitioner. But financial sacrifice need not be an essential requirement for a career in health.

Now, if we have adequate facilities, ample research funds, and sufficient talent, we can make enormous progress by developing a steadily increasing program of basic and clinical research. In my own association with the cancer program over the past few years, primarily as an administrator, my attitude changed gradually from real scepticism to conservative optimism. This change came about largely because scores of the best scientific minds are now attacking the problem with fervor and support. Yet, a few decades ago many talented workers felt that the approaches to basic research in cancer were so unpromising as to hold little hope of solution.

Although full knowledge of the cause of many chronic disease entities appears to be far in the future, substantial progress toward their control is now possible. There must be greater emphasis on efforts to translate present knowledge into improved medical and public health practice. Much more is known about chronic disease and disability than is being applied. We must demonstrate especially that they need not be accepted as inevitable among the older age groups.

Primary preventive techniques, as that term is generally understood in public health, are now feasible for some types of congenital heart disease, for secondary hypertension, syphilitic

heart disease, and rheumatic heart disease. Preventive measures may now also be taken against those forms of cancer in which environmental hazards are believed to be contributory or precipitating as well as against certain precursors of cancer.

Among the neurological disorders, it is already possible to institute primary preventive procedures to control cerebral palsy. Much blindness is preventable. Controlled use of oxygen will prevent retrolental fibroplasia among most premature infants who require this aid. Ophthalmia neonatorum and uveitis are preventable through control of the causative agents. Congenital cataract can be prevented among some patients. Avoiding the use of certain mydriatics during examination of the eyes of older people will prevent glaucoma.

### The Steps Forward

It is not unreasonable to ask why, since we know the preventive measures needed, we do not proceed at once to take the actions indicated. It may fairly be said that preventive action against chronic disease is under way already—by millions of people in thousands of communities.

Even the casual newspaper reader or television viewer is aware that syphilis and tuberculosis, are, broadly speaking, preventable. The public is learning that maintenance of desirable body weight will contribute to the prevention of diabetes, hypertension, and heart disease. The increasing popularity of long weekends and vacations would indicate, apart from economic factors, that some notion of proper balance between exertion and rest is spreading. On the other hand, the rate of accidents—on the highway, at work, and at home—would indicate either inadequate educational or preventive efforts or, perhaps, both.

The seriousness of neurological and mental disease is now gaining recognition, in terms of statistical prevalence, economic burden, and human misery. Nearly 1 person in 10 can expect to be hospitalized for a mental illness during his lifetime. Mental patients occupy a little less than half of the Nation's hospital

Office of Vocational Rehabilitation, the Food and Drug Administration, Saint Elizabeths Hospital, as well as the Public Health Service.

Because of a lack of basic data it is impossible to define the magnitude of the problem accurately. Excellent specific studies have been made in a few areas since the last nationwide data were compiled in 1936. But these are all too few, and there is no compilation for the country as a whole. If the proposed continuing, national sampling survey of disease and illness is approved, the Public Health Service will derive statistical estimates of the extent of the major diseases, injuries, and impairments. Estimates will be made of the nature and duration of the resulting disability and of the amount and type of medical and related services received.

Scientific research is fundamental in meeting the problem of chronic disease and disability. Thanks largely to science, the modern physician in a few minutes can accomplish more for a pneumonia patient with a penicillin injection than his professional predecessor could by staying up all night awaiting a crisis.

It is significant that—in spite of the new chemotherapeutic agents and antibiotics, improved diagnosis and surgical techniques, extensive use of blood plasma and parenteral fluids, and the steadily increasing emphasis and effectiveness of preventive medicine—our statistical trend of increasing longevity is not fully maintained after we pass the middle age brackets.

Although there has been some improvement in mortality toward the end of middle life, it has been relatively small, and in old age it has been imperceptible. In the United States the decline in mortality for men over 40 has not kept pace with the corresponding decline for men in Canada, Australia, New Zealand, and in most of the countries of northwest Europe.

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*By Lowell T. Coggeshall, M.D., Special Assistant for Health and Medical Affairs, Department of Health, Education, and Welfare.*

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Several explanations have been advanced as to why life expectancy among the older age groups has not increased more rapidly. None has been adequately tested. I will dismiss this subject for the moment with this question: Does the youngster who survives a deadly infection, thanks to an antibiotic, have a lessened tolerance to cancer, heart attack, or some other degenerative disease in later life?

We know that people over 65 have almost twice as many disabling illnesses as those between 16 and 64. Moreover, they respond less rapidly to treatment or care, usually requiring twice as much time for satisfactory response.

### Knowledge and Practice

Uppermost in the thinking of the Department has been the fact that the burden of chronic disease and disability falls so heavily on older people. However, we deem it unwise to attempt to limit research to what might be commonly regarded as problems of the upper age groups.

The most important discovery for the health of older patients could well come from a study in pediatrics. More fundamentally, a finding in biochemistry, physiology, or genetics may need only minor variations—or none at all—to be applied to conditions prevalent among patients of a given age.

Through basic and clinical research, progress toward effective treatment of some chronic illnesses has been rapid in recent years. Many patients formerly considered incurable can now be cured or their lives prolonged. Although medical research is making encouraging progress, any attitude other than an aggressive one toward further progress would be inconsistent with our beliefs. We must not make the mistaken assumption, though, that providing unlimited funds will solve any research problem. To the contrary, we must acknowledge that research progress will be limited always by at least three factors: facilities, trained manpower, and, above all, ideas.

Fortunately, private philanthropy and public funds have provided strong financial support for research into many major medical disorders. Unfortunately, however, much of the



voluntary health insurance, especially as it relates to long-term illness.

It is relatively easy to foster understanding of the need for individual protection against the costs of medical and hospital care. It is not simple, however, to elicit lasting motivation for the maintenance of good health. It is especially difficult to achieve the effective cooperation that is so clearly called for by the challenge of chronic illness. The physician, the professional nurse, the public health engineer, the medical social worker, the veterinarian, the chemist, the bacteriologist, and the statistician are all needed in this task. More important, the businessman, the legislator, the housewife, the teacher, and the newspaperman—the whole community—must lend a hand to the health worker.

The control of chronic illness and disability thus presents a dual challenge. The arduous quest for cause and cure offers a greater intellectual challenge than any hitherto known to the sciences of public health. And interdicting the causes and introducing the cures into everyday lives brings public health its ultimate challenge and responsibility—that of imbuing every individual with the knowledge and wisdom he needs to make his allotted years healthful, satisfying, and productive.

## Preventive Action

**PHR** In the joint statement, Planning for the Chronically Ill, issued in 1947 by the American Hospital Association, American Medical Association, American Public Health Association, and the American Public Welfare Association, this statement appears:

"The basic approach to chronic disease must be preventive. Otherwise the problems created by chronic diseases will grow larger with time, and the hope of any substantial decline in their

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incidence and severity will be postponed for many years."

The idea that a vast amount of chronic illness can now be prevented is still new although the Commission on Chronic Illness has done much to present means of prevention and to popularize the concept. Prevention means that—

- Thousands of premature babies in the future will not be blinded by too much oxygen during their struggle for survival.

- Because of insulin hundreds of thousands of diabetic persons are now in relatively good health although only a generation ago their lives would have been snuffed out or maimed.

- A simple, inexpensive test for detection and effective treatment makes it possible for thousands of women each year to be spared from having cancer of the cervix.

- Americans are more alert than ever before to the possible causes of lung cancer, which now accounts for 4 percent of all deaths among men.

- The Salk vaccine may prevent a high proportion of paralytic poliomyelitis.

- Serious rheumatic heart disease is preventable by prophylactic medication, as are many acute diseases which may produce chronic effects.

The Commission on Chronic Illness has listed more than 50 chronic diseases against which preventive action is possible.

### Primary and Secondary Prevention

Prevention includes measures which avert the occurrence of disease and measures which halt or retard the progression of disease into disability or death. These two major goals of prevention are classed as primary and secondary prevention.

Primary prevention means keeping a disease from occurring. For example, we prevent silicosis of the lungs and chronic lead poisoning by industrial hygiene.

In the primary prevention of chronic illness, effective nutrition is a major immediate goal. Millions of older people in this country subsist

beds. Two patients are admitted to a mental hospital for every patient discharged. Nearly a third of those admitted to the best mental hospitals never return to the community. As much as one-third of the operating budget in some States is devoted to care of the mentally ill.

The National Mental Health Act of 1946 gave Federal support to the development of research, training, and community services. The Joint Commission on Mental Illness and Mental Health, under authority of the Mental Health Study Act of 1955, is making an objective analysis of the prospects in improved methods of care, treatment, and rehabilitation of mentally ill patients.

The expansion of the State-Federal program of vocational rehabilitation through the 1954 amendments to the Vocational Rehabilitation Act is a heartening development in the health field. Vocational rehabilitation is no panacea, nor is it relevant to the needs of many chronically ill patients. But the effect of the previously inadequate level of financial support for the program was to deny its benefits to about three-fourths of the people who could make good use of the service. The downward trend in the proportion of handicapped men and women returned to self-reliance and self-support has now been reversed.

Enactment of the Medical Facilities Survey and Construction Act of 1954 is providing financial assistance to the States for additional chronic disease facilities, outpatient diagnostic and treatment centers, nursing homes, and rehabilitation facilities.

Despite the efforts being made, progress in chronic disease control seems disappointingly slow when compared with the relatively rapid control achieved with certain acute communicable illnesses. Perhaps the halting pace of chronic disease and rehabilitation programs stems from the intrinsic nature of the problems. They are inherently different from the public health problems of the past, which were susceptible by their very nature to efforts by a few in behalf of the entire community.

Previously, the individual assumed little responsibility for public health services—for

water purification, pasteurization of milk, enforcement of pure food and drug standards, immunization procedures, and the like. This is not to assert that continued progress can no longer be made through environmental controls. Rather, in contrast to the era of environmental controls, we are moving into an era of public health in which individuals themselves must assume more responsibility for protecting their own health.

Community casefinding techniques can locate undiscovered diabetes, and practicing physicians and dietitians can prescribe for and instruct the patient. It is the diabetic patient himself, however, who must use the insulin and watch his diet and exercise. The cardiac patient alone is ultimately responsible for following his physician's instructions concerning digitalis, diuretics, and low-salt diets. The health of the patients is, to a considerable extent, in their own hands. The chronic diseases and disabilities are thus more a problem of the individual than of the community. They cannot be controlled without the understanding, motivation, and cooperation of the individual citizen. This will require new approaches in health education.

Few members of the general public are consciously aware of this fundamental shift in the nature of the hazards to their health. Many, however, do understand the economic consequences of this relatively recent change in health and medical care.

Chronic disease can be catastrophic to families. The costs of hospitalization, physicians' services, nursing care, and drugs can be overwhelming. A great need, therefore, is for better insurance protection against the financial risks of long-term illness and other expensive diseases.

To be sure, more than 100 million Americans now have some form of voluntary health insurance protection, but there are important gaps in coverage. Too few retired persons are protected. Only 4½ million people have major medical expense insurance although this form of protection is growing rapidly. Clearly, a great deal remains to be done to strengthen

conomic security can be greater than that of long-term illness. Nothing eats away retirement income and lifetime savings more effectively than does a long, expensive sickness.

### Social Security Program

Let us take a look at the present public income maintenance programs and assess future trends in relation to the problem of chronic illness.

Most people who reach old age today are assured of at least a minimum income through the program of old-age and survivors insurance. During 1956 more than \$5½ billion will be paid out in benefits. Beneficiaries now number 8 million persons, including 6½ million aged.

We can confidently predict that more and more of the aged reaching retirement, or forced out of employment because of age or illness, will be assured of some income through old-age and survivors insurance. Others will have basic financial security through our public assistance programs. Planning in the field of chronic illness can, therefore, safely be predicated on the aged and chronically ill having at least minimum income. But assurance of a basic income is only one line of attack. What are we doing about their other problems?

The public assistance rolls include many persons with serious health problems. Of the 2¼ million recipients of old-age assistance in the United States, some half million are bedridden or have some impairment which requires substantial care.

Almost 250,000 persons receive public assistance for the permanently and totally disabled. More than 100,000 receive aid to the blind. In addition, some 450,000 persons receive aid to dependent children because of the physical or mental incapacity of a parent.

Thus, nearly 1½ million people receive State-Federal assistance because of need attributable primarily to disability, chronic illness, or the severe infirmities of old age. Furthermore, a high proportion of the 2 million recipients of old-age assistance who are able to care for their own daily needs have health and other problems relating to aging.

Although persons are eligible for old-age assistance at 65, the average age of the 2¼ mil-

lion recipients is 75. The typical recipient has been described as a widow aged 75, living alone in her own quarters, able to care for herself. If long-term illness strikes, as is likely at her age, expensive institutional care or special home care arrangements are almost inevitable.

### OASI Beneficiaries

The beneficiaries of old-age and survivors insurance (OASI) are representative of the health problems of the aged in their retired years. It seems worth while, therefore, to review some of the findings of our national survey of aged beneficiaries in 1951.

They spent an average of 2¼ days during 1951 in general hospitals. They were incapacitated in other institutions for a little more than 1 day. They spent another 12½ days confined to bed at home. The total is approximately 16 days of more or less complete incapacity. It excludes the days when, despite heart conditions, arthritis, or other degenerative ailments, the beneficiaries were up and around.

One in twenty-five reported bed confinement at home or in a hospital or institution for 14 weeks or longer during the year. Incapacity of this duration has a serious impact on the general well-being of the family unit even when no hospitalization expense is involved.

One in every 250 was incapacitated in an institution other than a general hospital for an average of almost three-fourths of the year. More than half spent a full year in such institutions. Most of this care was financed at public expense.

About two-thirds of the total number of days of institutional incapacity was in mental hospitals, tuberculosis sanatoriums, veterans hospitals, or county or city infirmaries—in institutions that depend on public financing even though some patients may be charged on an ability-to-pay basis. Even for the OASI beneficiaries in proprietary nursing homes, an element of public financing was often present in that a public assistance agency was underwriting the bill.

Although less than 1 in 4 had hospitalization insurance, the proportion was significantly higher for those recently retiring than for those

on diets which are inadequate in protein, vitamin C, and other essential nutrients. They suffer impaired health because of lack of education in dietary matters, poor dentition, or low income, which keeps them from purchasing certain important foods.

On the other hand, many people are overweight, with resultant excessive mortality from cardiovascular disease, diabetes, and other chronic diseases, thanks to a generous diet, ease, and lack of physical exertion.

Popularization of optimum diet and optimum weight would carry us a long way toward primary prevention of chronic illness.

Secondary prevention means halting the progression of a disease in its early stages. For example, we find early glaucoma, a condition of hardening of the eyeball, by a simple test, and prevent blindness through treatment.

Major advances in the secondary prevention of chronic illness have been the development of simple, inexpensive tests for early detection of many diseases and the assembling of a battery of tests for screening large groups of apparently well people.

The chest X-ray for tuberculosis and lung cancer, hemoglobin and blood sugar tests, cytology tests for cancer, especially cancer of the cervix, tonometry for glaucoma, height and weight determination, and vision examinations are practical tests for the early detection of chronic disease. Combining the tests into a multiphasic screening battery to test large groups of people appears to be the most feasible means for health departments to accomplish large-scale prevention of chronic disease.

Multiple screening is steadily gaining popular support because it uncovers many cases of previously unrecognized and important diseases. The technique provides an excellent opportunity for health education. It develops and strengthens the patient-physician relationship by referring individuals to their physicians for necessary care. It is inexpensive, as low as 12 tests for \$5.

### Epidemiological Study

Research is another important aspect of the

prevention of chronic illness. Needed perhaps most of all is epidemiological study of chronic disease. For example, why does coronary heart disease cause about 25 percent of all deaths in the United States today—more than in any other country of the world—even when we take into account the age distribution of the population? Patient, epidemiological study will help unravel the answer.

We also need research to improve and expand the array of tests for multiple screening.

State and local health departments, working with the medical profession, voluntary health agencies, and many other community groups, are now gaining the experience necessary to carry through the next great achievements in preventive medicine—the prevention of chronic illness.

## National Health Trends



In little more than a decade, medical research has made a major contribution in adding 5 full years to life expectancy at birth. But this gift of added years is a gift of years heavily weighted by chronic illness. With the conquest of the diseases of early life, more people are surviving to the ages when cancer, heart diseases, or other chronic illnesses are most prevalent. That the chronic diseases still unconquered tend to be those associated with aging takes on even greater significance for the future whenever higher proportions of our population will be aged.

Economic security and the maintenance of income have a close relationship to the problems created by chronic illness. Many of the chronically ill cannot work at all. For others, income is reduced, or the period of productive employment is lowered. No threat to eco-

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*By Charles I. Schottland, Commissioner of Social Security, Department of Health, Education, and Welfare.*

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vented. The Mental Health Study Act of 1955 has made an important start in this direction.

Using another line of attack on chronic illness, the State-Federal programs of vocational rehabilitation are demonstrating that many individuals handicapped by chronic illness can be restored to productive work.

To take heart disease as an example, the Office of Vocational Rehabilitation has granted funds for research into the rehabilitation problems of persons with heart disease; has provided grants-in-aid and technical advice to State rehabilitation agencies which, in turn, offer counseling, physical restoration, and job placement services; and has encouraged the establishment of local work evaluation units for heart patients.

For the 2,500 heart disease sufferers restored to productive lives through the program in 1955, earnings after rehabilitation were 15 times as great as earnings at the time of applying for rehabilitation services.

Children, too, have a direct stake in the fight against chronic illness. With the assistance of Federal funds, the States have made great strides in extending and improving services for promoting the health of mothers and children. Through prenatal clinics and well-child clinics, and through the provision of health examinations, nursing services, and immunizations, the younger population is equipped with its greatest weapon against chronic illness—a healthy start in life.

The crippled children's program locates children in need of care and provides the means of restoration through diagnosis, medical and surgical treatment, and the alleviation of unfavorable social and psychological influences that increase the degree and duration of disability. Through grants provided for special projects of regional or national significance, the benefits of medical research and new techniques have been made available to children with congenital heart disease who live in rural areas where highly specialized care is lacking.

This view of the future would have had better perspective if we were able to focus against a background of reliable data on the extent of illness and disability.

## Illness Absenteeism

**PHR** Five years ago the Research Council for Economic Security undertook a nationwide survey on prolonged illness-absenteeism among employed persons. The survey includes 6,200 cases of nonoccupational disability only. Analysis of the data and the summary report will be ready for publication later this year. In the meantime, by reviewing the results of a subsample, which represents the illness-absence experience of some 80,000 man-years during which approximately 3,000 absences of more than 4 consecutive weeks each were reported, I can indicate what some of the findings are likely to be.

### Meeting the Costs

The average gross medical care cost incurred by the absentees was some \$360, but in about one-fourth of the absences medical care cost more than \$500. The largest share was spent for hospital services. A little more than one-third was spent for physicians' fees. Almost 60 percent of the fees were for surgical services.

The extensive development of employee benefit plans in recent years is reflected in the subsample. The employing establishments all had some kind of medical care plan. As a result, 88 percent of the absentees received some benefits to help pay these costs. The others, who either were not members of the group plan or were not hospitalized, used medical services not covered by the plans.

Major emphasis in all of the plans is on hospitalization and indemnity payments for surgical procedures. Very few provide benefits for nonsurgical medical services in the hospital. Even fewer provide benefits for medical care costs incurred outside the hospital.

The benefits received covered almost 77 per-

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*By Gerhard Hirschfeld, director, Research Council for Economic Security.*

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who had come on the OASI rolls in the early years of the program. This indicates growth of voluntary health insurance will help to overcome the problem of financing care of the chronically ill.

The beneficiaries covered by hospital insurance averaged more days in general hospitals than did those without protection against illness costs: 2.8 days in contrast to 2.1. This difference is significant in the light of the lower average number of days of incapacity of all kinds for beneficiaries with insurance: 12.7 days in contrast to 16.6 days. It indicates the effect of prepayment in removing the cost barrier to hospital care.

### Outlook for Health

From other sources, we know that an increasing proportion of the population will be able to continue their insurance against hospital and medical costs after retirement. This is hopeful, but there is still a long way to go. While about two-thirds of the population under 65 now have some form of prepaid hospitalization insurance, fewer than 1 in 3 of the aged have this protection.

We see growing concern for the medical care problems of public assistance recipients. The characteristics of recipients are such that we can assume they will in greater degree continue to need long-term care outside their own home. The 1950 census indicates that between 1940 and 1950 the number of persons aged 65 and over who were living in institutions other than general hospitals rose twice as fast as did the total aged population.

The largest relative increase in institutional care took place in homes for the aged and in nursing homes. This factor will add to the cost of medical care as a component of public welfare costs. Efforts of licensing and standard-setting authority, to which the 1950 Social Security Act amendments gave a long-needed impetus, and efforts of nursing-home operators to raise standards can be successful only if better financial support and more adequate personnel are forthcoming.

Our medical research efforts have been tre-

mendously strengthened, and further expansions are proposed. We must also increase our speed and efficiency in applying these findings to the treatment of patients and to our public health preventive programs.

The 1954 amendments to the State-Federal hospital construction program opened up new opportunities for the construction of chronic disease hospitals, nursing homes, diagnostic and treatment centers, and rehabilitation facilities.

I do not need to emphasize the importance of making hospital beds available to the chronically ill in special hospital wings, in nursing homes, and in facilities geared to long-term care and costing the patient much less than care in short-term hospitals. But I do want to point out that it would be unfortunate if methods whereby people pay for long-term care were to lag seriously behind the expansion of suitable facilities.

One hundred one million people in this country now have some form of insurance against hospital costs. Only a fraction, however, have insurance that covers nursing-home care or that is flexible enough to extend the days insured when costs per day are reduced.

A long stride forward was the recognition that there are other and better ways of caring for the chronically ill than in a hospital bed. We are seeing impressive demonstrations of what can be achieved through home care programs designed to provide the most suitable care for the invalid, in many instances at lower cost. Our progress is dramatically demonstrated when older people who have spent long years in mental hospitals are returned to normal existence and happy adjustments in their own communities. Care at home costs much less than care in a specialized hospital, and a bed is released for a younger patient who can be returned to productivity.

It would be folly to think that we can solve mental health problems by a wholesale exodus from mental institutions. But there is evidence that, through improved methods of care and treatment, the average length of hospitalization for mental patients can be materially reduced and a great deal of mental illness can be pre-

years of age. Certainly in this age group, a well-organized program of regular examination, early diagnosis, education, and other means, could be effective in preventing short-term illness from developing into prolonged illness.

Industry is in the best position to introduce practical measures for such a program. Prolonged illness-absenteeism may cost a company with 100 employees as much as \$10,000 a year.

## Chronic Disease Services

**PHR** As a member of the Subcommittee on Chronic Disease and Rehabilitation of the Committee on Administrative Practice, American Public Health Association, I shared the responsibility of developing a manual on the health department's role in chronic disease and rehabilitation services.

In order to prepare the manual, which is nearly complete, the subcommittee found it necessary to learn about the type and extent of services being performed in health departments. Generally, we have found that State and local departments are not acting as effectively in the field of chronic illness as current professional knowledge permits even though they offer a variety of services for the chronically ill.

### State Health Departments

For reference the subcommittee used the Public Health Service publication, *Distribution of Health Services in the Structure of State Government*, edited by the late Dr. J. W. Mountin. In attempting to bring Dr. Mountin's work up to date the subcommittee con-

cluded that at the State level the widely disparate picture presented in 1950 continues in a similar manner today although more programs have been developed and more States appear to be giving attention to chronic disease services.

Today there is also a wider understanding of the fact that for a long time most State health departments have been providing services related to chronic disease. However, these services are being performed within the context of the more traditional activities.

For example, under the banner of maternal and child welfare, there are three major programs: (a) the reduction of maternal mortality, particularly in its program to control toxemia and hemorrhages of pregnancy; (b) the reduction of infant mortality with recent emphasis on the prevention of premature birth and the prevention of death from prematurity; and (c) the provisions for services to crippled children.

In other traditional areas we find rheumatic fever programs; some aspects of programs for the control of tuberculosis, syphilis, and encephalitis, and for the elimination of pellagra; increasing statistical studies in applying the epidemiological approach to the study of chronic illness; increasing attention to screening and early detection; new emphasis on health education services; and provision of certain laboratory services. In most States we find various degrees of participation in rehabilitation programs.

In summary, the subcommittee study shows a long list of types of services only a few of which, however, are carried out by, or through, more than a small number of State health departments. The broad programs of California, New Jersey, and New York are the exception. There is more service and more consistency of program in States where the State health department received the stimulation of Federal funds, both regular grants and special grants.

### Local Health Departments

Information on local health department services is derived from a subcommittee survey conducted in June-October 1955 under a contractual agreement between the American

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*By G. D. Carlyle Thompson, M.D., executive officer and secretary, Montana State Board of Health.*

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cent of the hospital charges and about 57 percent of the surgeons' fees but met only 10.5 percent of all the remaining medical care costs. The total benefits received paid for about 54 percent of the gross medical care costs. Some 31 percent of the absentees had other insurance coverage from which they drew some benefits.

The average net medical care cost—after deducting all benefits from insurance sources—was \$157. The average net cost for absentees in the higher income groups was somewhat greater, but it was not materially less for those in the lower income groups. This meant that a higher share of their earnings went for the medical costs.

For absentees whose annual earnings totaled less than \$3,500, and the largest number were in this group, the average net medical care cost incurred during their absence was \$138. The average net medical care cost for the single absence of the average wage earner was 5.5 percent of his annual earnings. For the absentees earning between \$3,500 and \$5,000, it was 3.7 percent. For those earning more than \$5,000, it was 3.3 percent.

To the medical care costs must be added the loss of the wages that might have been earned. Ten weeks was the average duration of absence, and \$800 would represent the average gross wage loss.

Again, the extensive development of employee benefit plans is reflected in the fact that 86 percent of the establishments had either sickness compensation or sick leave plans. Many had both. Of course, no insurance plan seeks to provide benefits equaling the full wage loss. These plans, too, like the hospital and surgical programs, are focused on the short-term disabilities. As a result, though they succeed in reducing the wage loss that absentees might have incurred, they succeed only to the extent of paying 43.5 percent of the wages the employees might have earned. The average net wage loss was about \$450.

Adding this wage loss to the average net medical care cost, we find that the average prolonged illness-absence among a typical group of employed workers represents a total

cost plus wage loss for the single abs approximately 15 percent of the annual earnings.

### Financial Sacrifice

A primary objective of the survey was some idea about the economic impact of prolonged illness. On his return to work employee in the sample was asked what special sacrifice he made to pay the cost of illness. Here is the picture.

- 43 percent drew on savings set aside for special purpose, such as a house, car, or household appliance.
- 16 percent borrowed money.
- 15 percent arranged to pay for the medical care on a payment plan.
- Someone in the immediate family of 4 percent of the absentees went to work to help meet the expenses of the illness.
- 2 percent sold property or other belongings.
- 2½ percent applied for assistance outside the family, from a private welfare agency, public agency, company loan fund, or the church, for example.

A number resorted to more than one of the methods of meeting the costs.

### Key Role for Industry

We have only begun to provide coverage for long confinements in the hospital, for unusual ancillary charges, and for the services of physicians other than hospital surgeons. There is almost no coverage for institutional care other than in an acute or general hospital. The development of such coverage must, of course, await further progress in construction of adequate facilities. There are great gaps in the coverage of services and other medical costs outside institutions—to cover physicians' care in the office, in clinics, and at home; to pay for other professional services and facilities while the patient is home or for continuous care after his return to work. The latter type of coverage is of particular significance in chronic disabilities.

About half of the absentees were under 45



The situation probably will become worse before it gets better. The public requires a shock to awaken a sense of responsibility for action. The following suggestions and predictions are offered.

1. Chronic illness must be considered broadly. It includes disabilities resulting from advancing age, crippling injuries that can be helped by rehabilitation, and general long-term illness. The individual must learn to live with "what he has left."

2. General hospitals should be powerhouses, not storehouses, in the treatment of prolonged illness. A general hospital is not intended for perpetual care. In prolonged illnesses, the hospital serves best for intermittent periods of intensive service.

3. Home care is a desirable alternative, not a "poor relation" of hospital inpatient service. The problem of cost is important, but more important is the idea that a patient may be a hospital patient while receiving supervised care in his home.

4. Outpatient service for long-term illness will increase at hospitals. This is not incidental; it is fundamental. Services provided at a hospital conserve the time of attending physicians, who should be paid for their work to assure continuity in the personal relationship.

5. Long-term illness generally leads to economic dependency. It causes interruption of employment as well as expenses for medical care. Many persons will require public support to supplement insurance benefits and private resources.

6. Much can be accomplished through better use of existing facilities and personnel. Home care by visiting nurse societies may avoid the need for additional hospital beds. Medical services at homes for the aged can serve the health needs of many residents. Rehabilitation through physical medicine, training, and sheltered employment will restore many disabled persons to a condition of self-help or self-support. Recreational and personal services will reduce some of the illnesses attendant upon lonesomeness and boredom.

## Meeting the Costs



To an increasing extent, over the years, the medical reasons for people being on public assistance have been in the ascendency. About 43 percent of the 425,000 public assistance recipients in the State of New York in December 1955 were indigent because of a chronic illness or disability. This number included about 100,000 receiving old-age assistance, 40,000 receiving aid to the disabled, 4,000 receiving assistance to the blind, plus about 20 percent of the family heads of the 200,000 aid-to-dependent-children families and of the 80,000 home relief units. Considering all family units as individual cases, we estimate that 73 percent of the 225,000 cases on the public assistance load are there because of long-term illness.

In 1951 the average monthly expenditure for medical care for each public assistance recipient was \$3.88 as compared with an average monthly grant for all other purposes of \$39.35. In 1954 it was \$7.94 compared with an average of \$41.62 for all other purposes. The figures for medical care include physicians' services, hospital and infirmary care, drugs, nursing and physical therapy services, and laboratory services. Private nursing-home care is excluded.

The cost of hospital care accounts for a large part of the doubling of medical costs over the past 4 years since most welfare districts pay for hospital services on a per diem basis of actual costs, and, as everybody knows, hospital costs have been rising continuously.

Drug costs have become a serious problem except in the local welfare districts with rigidly controlled programs. Drug costs now comprise from 5 to 25 percent of the total costs of medical care whereas rarely did they exceed

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*By I. Jay Brightman, M.D., assistant commissioner for welfare medical services, New York State Department of Health, on detail to the New York State Department of Social Welfare.*

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Public Health Association and the Public Health Service.

We questioned 271 local health departments, generally the larger ones and the ones more likely to be undertaking chronic disease services. Of the 187 replies, 60 percent considered chronic disease activities to be a major responsibility, even though less than 10 percent of the group had established a division or unit devoted specifically to chronic disease.

As one might expect, the departments which consider chronic disease a major responsibility have developed a wider variety of services, and they participate in more of the services provided by other agencies.

Few of the departments had a working knowledge of most of the other chronic disease services available in the community.

More than 60 percent had participated in some kind of community survey relating to chronic disease. About 50 percent have seen the findings put to work by the community.

Only about half of the departments maintain any kind of current morbidity data on chronic disease and disability.

In a large proportion of the reporting departments, public health nurses make use of health workers serving in a wide variety of special fields. These other workers are employed, for the most part, by agencies other than the local health department.

For example, almost 90 percent of the local health departments in the survey make use of social workers, but less than 20 percent employ such personnel directly. Almost 75 percent of the respondents use the services of nutritionists, but less than 25 percent employ a nutritionist on their own staff.

It may come as a surprise that almost 40 percent of the local health departments play a part in providing local chronic disease institutions with nutrition consultation. Obviously, some of these departments use the nutrition consultant of the State health department, either directly or through their public health nurses.

Most local departments provide for physicians or health department patients, directly or indirectly, such laboratory services as cytologi-

cal studies for cancer cells or blood sugar determinations.


However, between 60 percent and 70 percent do urine analyses for both sugar and albumin and read chest X-ray films for tuberculosis, cancer, and heart disease.

A large proportion of local departments evidence an interest in providing consultative services to local welfare agencies. Other studies by the American Public Health Association, by its Subcommittee on Medical Care, raise some questions about the extent to which such services are actually used, however.

Most of the personal health services directly administered by the local health departments in the chronic disease field are in traditional areas of public health practice, but almost half of the departments offer some kind of screening program for more than one disease entity. And a large majority claim to offer an active referral service for patients needing care not directly provided by the health department.

A small number of the departments have experimented with nutrition classes, group sessions for obese persons, and followup of diabetic patients to make sure that medical supervision is maintained. Many departments offer a regular followup service of this nature for patients with rheumatic fever or for patients recovering from acute poliomyelitis.

## Suggestions and Predictions

 Chronic illness is a daily disaster. More people are living long enough to suffer from prolonged illness and disability.

The problem is acute and requires community action, but many folks consider it a technical matter, to be solved by experts in medicine, public health, and hospital administration.

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*By C. Rufus Rorem, Ph.D., C.P.A., executive director, Hospital Council of Philadelphia.*

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The situation probably will become worse before it gets better. The public requires a shock to awaken a sense of responsibility for action. The following suggestions and predictions are offered.

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*By I. Jay Brightman, M.D., assistant commissioner for welfare medical services, New York State Department of Health, on detail to the New York State Department of Social Welfare.*

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10 percent in 1951. The increase is largely attributable to the remarkable advances in drug developments over the past decade.

Recognizing that the increased drug costs are largely due to the recent development of "wonder" drugs, drug audits in New York State still have indicated many areas where drug costs could be reduced by amounts varying from 10 to 15 percent. Such reductions lie in the area of greater reliability upon older drugs that are still tried and true, over which new proprietary medications have no established superiority. There is also the area in which more drugs are prescribed than the patient can possibly use without having toxic effects or without giving the drugs away or throwing them out. One gains the impression that the prescribing of drugs, the costs of which are rapidly approximating the costs of physicians' care, is a most inefficient operation.

Physicians' fees have not accounted for any major increase in total costs over the past 4 years although a 20-percent increase was allowed in 1954.

It is doubtful that much reduction in costs can be made in the hospital field except for greater awareness regarding the discharge of chronically ill patients to less costly places which can provide adequate care, mainly, to nursing homes and infirmaries, and to home care programs. We have noticed slight evidence of excessive physicians' calls. We do believe that physician cooperation could reduce drug costs to a small extent.

Many local welfare commissioners believe that welfare costs for the chronically ill are excessive, and they are alarmed at the continuous rise in these costs. Nevertheless, the majority recognize that the problems of welfare care are increasingly related to the problems of chronic illness and aging and that medical costs may be expected to increase both because of the greater number of such persons receiving welfare assistance and because of the continuously increasing costs of care.

Our survey of nursing and convalescent homes in upstate New York, undertaken in cooperation with the Commission on Chronic Ill-

ness, indicated that the majority of the homes provided adequate medical and nursing service. Few of the homes, however, provided medical or social rehabilitation, recreational services, or planning for any disposition other than continued stay at the home. Yet, a high percentage of the patients were out of bed except to eat or to rest, were able to walk alone or with the assistance of a cane or a crutch, were mentally clear, and were completely continent. It appeared that there should be immediate steps taken to provide more dynamic social and recreational programs for the long-term and mentally clear patients, and that there should be more intensive social and rehabilitation planning by physicians and social workers concerned with the individual patients. These additional services would naturally increase the costs for care in nursing homes.

The New York State Department of Health and the State Department of Social Welfare have developed a joint demonstration program for the rehabilitation of disabled public assistance recipients at the State rehabilitation hospital at West Haverstraw. The objective is to demonstrate what can be done for these patients and, if the results are favorable, to encourage local welfare departments to provide the full cost of such service.

## A Call for Action



The summarizing committee agreed that we would like to consider the National Health Forum from the viewpoint, at least in part, of a member of the "consuming" public—one who must approve or support the types of action that have been discussed in the past 2 days.

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*By Morton L. Levin, M.D., assistant commissioner for medical services, New York State Department of Health, and chairman of the summarizing committee of the National Health Forum.*

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We were impressed by the fact that this has been truly a national forum on health. We have received greetings from the President, from 31 State governors, in person from Mayor Robert F. Wagner, and from Mrs. Franklin D. Roosevelt. We have been given the assignment of trying to set up guidelines for the Nation for needed action on chronic illness. In considering what action is needed, we have heard from 17 national, 7 State, and 19 local organizations, from State health commissioners, representatives of hospitals, a school of public health, and various types of voluntary and governmental agencies in local communities.

### The Type of Action

What really was the subject of the forum? What have we been talking about? The summarizing committee agreed that these questions needed some clarification.

We have heard chronic illness described as "a daily disaster which is an acute emergency," and as "a major health problem which accounts for more than 70 percent of sickness." At the same time, we have heard chronic illness characterized as something in which hospitals, physicians, and the public generally are not greatly interested and for which it is hard to get money.

There seems to be some inconsistency in these two references to the term chronic illness. It hardly seems possible that there is a widespread lack of interest in the major causes of illness and disability. Perhaps what many people think of as chronic illness is not what we have been talking about, or only part of what we have been talking about. Apparently, to many people chronic illness means only the terminal, hopeless stages of illness, whereas it has been well established that chronic disease, in the sense in which the forum has used the term, need not necessarily bar a person from seeking the highest responsibility in our land.

Both by implication and by definite statement, the panel discussions have revealed that we have been discussing the effects of a large group of diseases which are well known by their individual names, such as cancer, heart disease, arthritis, cerebral palsy, vascular dis-

ease. Though many people are familiar with these diseases, apparently they do not know them under the general name of "chronic illness."

Most of the forum discussion was focused on certain types of action, which are needed for many chronic diseases at the same time—action that is not usually planned for a single chronic disease because it is needed for many chronic diseases at some stage of their course. One might call this type of action the common denominator aspect of chronic illness, and apparently this was the subject of the forum.

The summarizing committee was impressed with the repeated evidence that few people understand or are concerned about these common denominator types of activities. One possible conclusion to be reached from the deliberations of the forum is that the first action needed is to explain to the people—and especially to those who, by reason of money, power, and prestige, control community action—exactly what is meant by chronic illness in the terms of reference to the forum. Perhaps the forum has demonstrated that more of this type of explanation is needed before the desirable action is likely to take place.

The forum discussed parts of the common denominator aspects of chronic illness under various headings. Two panels discussed how to provide better care for the chronically ill at home or in institutions. Another panel was devoted to a specific kind of care, that called rehabilitation. Two panels were devoted to action by certain agencies—one by State health departments and one on what various types of city or county agencies were doing in this field.

### Some of the Conclusions

The committee agreed that the most significant contribution made by the various panels was in describing examples of successful community action. We have heard many accounts of what may truly be called "success stories"—in developing home care programs; in linking hospital care with nursing homes, old-age homes, rehabilitation facilities, and home care;

and in bringing rehabilitation to people in nursing homes.

The examples we heard indicate that some communities have developed the know-how needed to lessen the disabling consequences of chronic illness, to give sick people the best chance to get back on their feet (that, apparently, is what is meant by "rehabilitation"), or to live their remaining years with as much activity, comfort, and decency as are reasonably possible. But, for some reason, the knowledge gained from these successes is not being used in most places. As to "why not?" the forum did not provide any specific answer.

We do not know why these common denominator types of action, which are obviously desirable, important, and useful, are failing to take place in more areas; we also do not know to what extent they are not taking place. The descriptions of the studies made by the Commission on Chronic Illness in Baltimore, Md., and Hunterdon County, N. J., the rehabilitation study going on in Kansas City, Mo., and in nursing homes in Peoria, Ill., suggest that the gap between demand and supply may be greater than has been suspected. These studies should tell us what are—to use one of the clichés in the field—the unmet needs.

Implicit in this conclusion is the need for an inventory of the extent of illness and disability in the Nation. The findings of the forum support the desirability of conducting a national survey of morbidity as a first step toward determining the most important gaps in providing care for people with all types of illness and especially for people with chronic diseases and disabilities.

A second implication is that a part of the money now being spent by various groups for specific diseases could well be earmarked for support of the common denominator services which are of importance to many chronic diseases. The forum also brought out the suggestion that some of these funds should be expended on an appraisal of how effectively the

rest of the money is being utilized for the various special programs.

Largely missing from the various discussions was a description of "the source of motion" for the action described. We were told about what happened but not why. We did not learn how it happened that a particular person or agency took the initiative for action. Exploration of these hidden springs of community action should prove helpful to those interested in promoting action in their own communities.

The discussions, however, did reveal some suggestions concerning the type of person or agency who might take the initiative. A president of a county or city medical society, a health officer, a council of social agencies, a visiting nurse association, a welfare department, and a general hospital were cited as specific examples.

The forum agreed that, when health leaders decide to initiate action, they should, first of all, bring people together to decide what is most needed in their community, and then develop a plan for specific action that people will understand and can start with; in other words, they should not necessarily try to do everything that needs doing at the same time.

As to priorities among programs recommended, there were outstanding examples: for instance, by almost unanimous choice, a home care program. Other activities which have high community acceptance are a referral and counseling service and rehabilitation programs for special groups of disabled persons, such as those in nursing homes.

Finally, the forum brought out the point that, if the need is shown for more effective services for the chronically ill, a good community leader usually can find the necessary money to provide at least part of these services. Apparently, the leader for developing these services should be an "actioneer"—a word coined by the forum—meaning one who combines the ability of an auctioneer in selling programs and the ability of a buccaneer in overcoming obstacles and opposition.

# SERVICE with DISTINCTION

*a story of the*  
Public Health Service

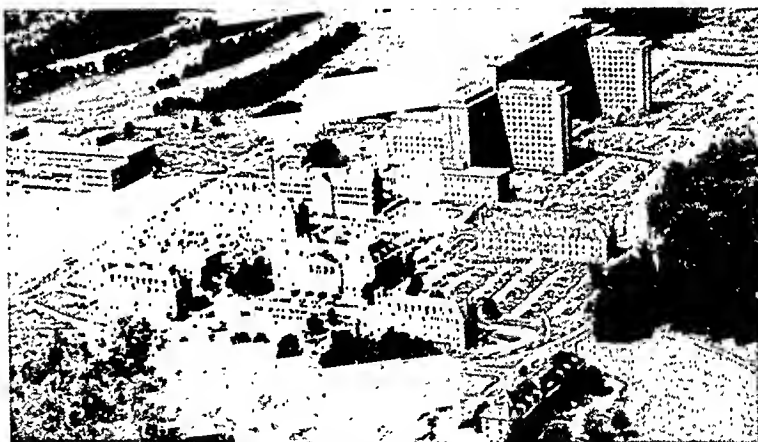
Filmstrip: 35 mm. black and white, 12½ minutes, with music and narration on record. 1955.

Filmograph: 16 mm. black and white, 10 minutes, with sound track. 1955. Identical with filmstrip but for use in a motion picture projector. "Dissolves" and fast pacing give illusion of motion.

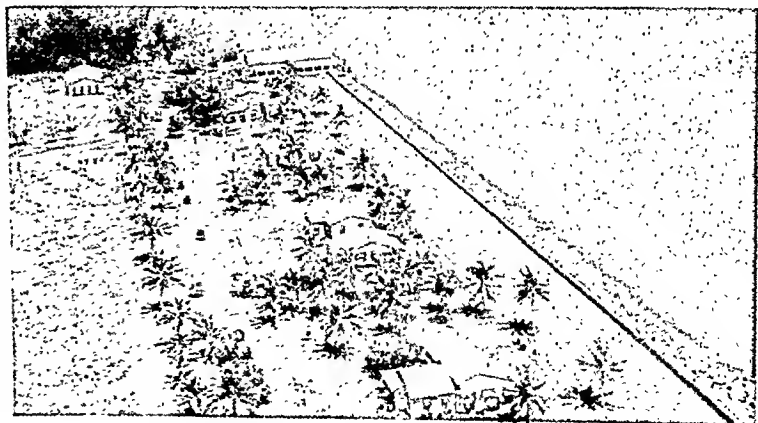
Audience: Professionals in the fields of clinical medicine, medical and biological research, and preventive health services.

Available: On loan from: Chief, Recruitment Branch, Division of Personnel, Public Health Service, Washington 25, D. C.

**S**ERVICE WITH DISTINCTION is a pictorial story of Public Health Service activities throughout the world. Physicians, nurses, sanitary engineers, dentists, veterinarians, and other categories of professional personnel are shown carrying out representative activities in the Service's many continental stations and its overseas programs. Although useful in orienting audiences to the work of the Service, the filmstrip and filmograph stress opportunities for careers for commissioned officers in the Public Health Service. Opportunities for temporary duty in national emergencies as a member of the Service's Commissioned Reserve are also described. Using the technique of "quick cuts," "Service With Distinction" takes the spectator on a tour of the Service's installations in this country, harks back to its origin in 1798, and then describes professional opportunities in the fields of clinical medicine, research, and preventive health services. Scenes shown are those of PHS officers carrying out their assigned duties.



National Institutes of Health, Bethesda, Md.



United States Quarantine Station, Miami, Fla.



## The Story of the Service Is a Story of People

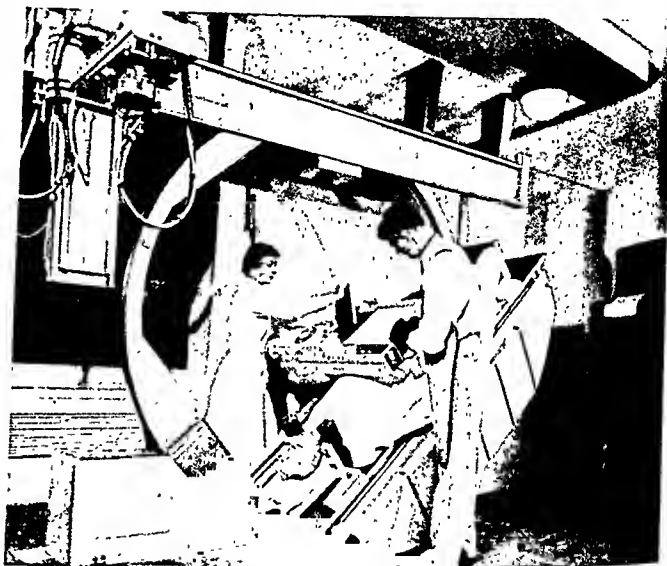
"Service with Distinction" stresses the role of Public Health Service professional personnel, rather than installations and institutions. The story, as it unfolds, is about people, such as Lumsden, Stiles, Rosenau, Francis, Armstrong, and Mahoney, who have made the Service a vital health force through the world. The film moves on to describe the work of the Public Health Service commissioned officers in the United States and on health missions in other parts of the world.



... they have served with distinction since 1798



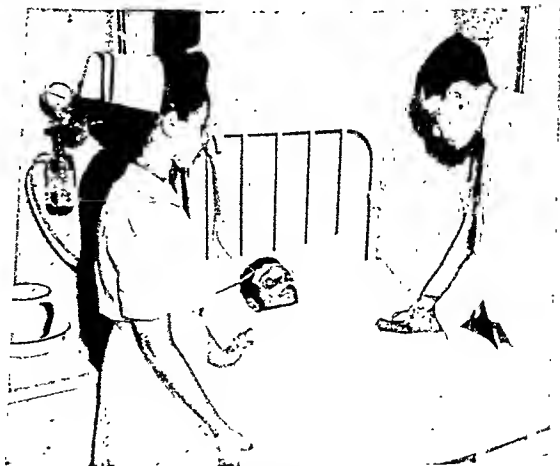
Lumsden and others have left their mark



... more than 250 occupational specialties

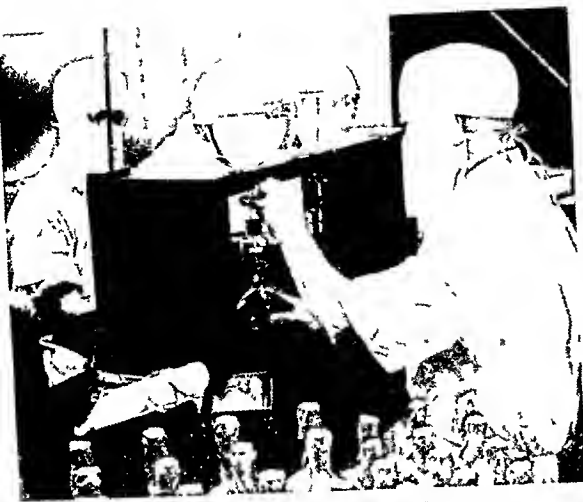


... a long-established career organization



... medical care ...





... medical and biological research ...



... preventive health services



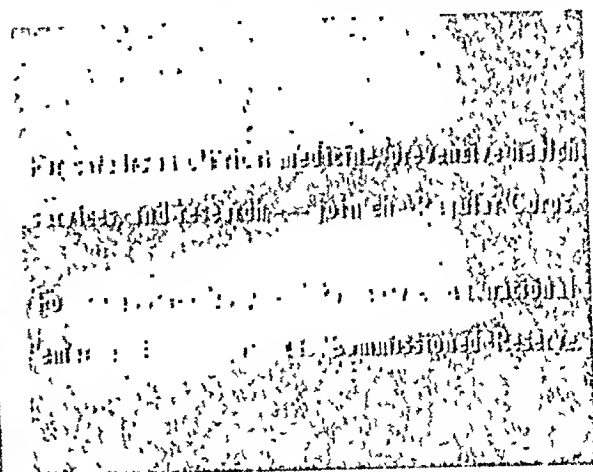
... a medical officer in Liberia



In national disaster, the Commissioned Reserve



For commissioned officers, a variety of professional experience



# Variations on the Theme Mental Health in Nursing

By RUTH E. SIMONSON, R.N.

ON a Sunday morning in March 1955, I opened the *New York Times* to the article, "Nebraska Fights Mental Illness."

As I read the description of the many innovations to enhance the treatment potential of mental patients, and the discussion of the part the institute could take in solving the problem of mental illness, my thoughts turned to what the Nebraska Psychiatric Institute could mean to nursing.

I visualized the new institute as providing an opportunity not only to advance our knowledge about psychiatric nursing but also to apply the knowledge to general nursing.

At this, the dedication of the institute as a research center in the care of the mentally ill, it is appropriate to consider some of the opportunities for psychiatric nursing which are

specific to this setting. Psychiatric nursing is being redefined, and the imperative need for both independent study and collaborative research is recognized.

For example, the statement of Dr. Arthur P. Noyes (1), that the nurse should be a psychotherapist in her limited but definite field, indicates that the breadth as well as the limits of psychiatric nursing must be made increasingly clear. The nursing profession itself must assume the responsibility for identifying its area of function and for describing and justifying what is done.

Psychiatric nursing needs exploration and study as to how it can enrich the profession of nursing. I do not question that psychiatric nursing leadership will do the exploring and at the same time safeguard its responsibility. My concern is with the enrichment of general nursing.

Will the schools of nursing, the nursing services, and community nursing programs, in their day-to-day work with the ill, take advantage of the opportunity to study psychiatric content?

Will general nursing work collaboratively with psychiatric nursing in applying psychiatric content to the care of the general patient?

## Nursing and Mental Health

At its annual conference with State mental health authorities in December 1954, the Asso-

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*Miss Simonson is mental health nurse consultant for Public Health Service Region II, New York City. Her speech on mental health in nursing, in its original form, was part of the observance of Mental Health Week, May 1-7, 1955, when the Nebraska Psychiatric Institute, Omaha, was dedicated. Miss Simonson is a member of the council of the newly established mental health section of the American Public Health Association and vice chairman of the Interdivisional Council on Mental Health and Psychiatric Nursing of the National League for Nursing.*

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ciation of State and Territorial Health Officers gave formal recognition to the importance of mental health in nursing. At that meeting the association recommended that the principles of psychology be incorporated into all nursing and, particularly, into the community aspects of nursing (2). The health officers also recommended that each State mental health authority employ one or more mental health nurses to help carry out this recommendation.

The nursing profession shares the abundant interest in mental health evident in other professional groups. By its very nature, nursing is a personal and individual service which fosters close relationships. The nurse herself inevitably affects the mental health of the patients and families with whom she works.

The setting in which nursing is practiced offers its own unique opportunity for the promotion of mental health. The setting may be a hospital, a home, a clinic, a school, or a factory. The responsibility may be to the sick, to the convalescent, to the healthy. Yes, the nurse has opportunities in every phase of the mental health program. She shares in the prevention of mental illness, in the treatment of the mentally disturbed, in the rehabilitation of the mental patient.

Mental health in nursing lends itself to many variations. We accept that nursing has the potential for working constructively in mental health. Let us think of ways to nurture this potential.

### The Use of Self

In nursing, we have tended to look at ourselves as outside the patient's problem. But little by little we have begun to tear down the wall that we built around ourselves. We are beginning consciously to take into account what the nurse, in her use of self, brings to a situation that changes it. The fact that there has been a shift in nursing research from functional studies in nursing service to a concern with nursing care which emphasizes nurse-patient interaction is proof of this change.

The report on "Favoritism in Personnel" in the February 1955 issue of *Nursing Research*, published the not-surprising conclusion that nurses like certain patients better than others

and that this factor makes a difference in the nursing care she gives. Her approach to the preferred patient is warm and friendly. He is respected as a person. The approach to the nonpreferred patient is more routine and business-like. He is treated as a patient (3). Recognition of this hitherto vaguely sensed bias is but the first step in its correction. The next step must be the development of appropriate methods to help the nurse meet the basic need of every patient to be treated as a person whether he is preferred or nonpreferred.

We have been content too long to emphasize the importance of recognizing the emotional components of nursing care. We have paid too little attention to the development of the skill that helps us apply the knowledge we have accumulated. Unfortunately, knowledge cannot be transferred directly and automatically to appropriate situations, for learning does not develop in that way. It is fostered in a climate where new approaches to traditional tasks can be tried out and modified.

Dr. George E. Gardner, writing in *Mental Hygiene* about higher education and mental health, makes the point that the development of emotional maturity is the first mental health task of the student. In that sometimes elusive search, he says, it is of primary importance to establish a realistic concept of one's self—one's ability and one's potentiality—and to establish a realistic appraisal of the responses to be expected from others (4).

Self-awareness, insight, and the realistic appraisal of responses come to the nurse as she works directly with her patients. That step in the learning process is hastened with competent guidance.

In a study completed in 1954 for the Public Health Service, Frances Kreuter and Marguerite Kakosh have developed criteria for qualitative appraisal of nursing care. I have been in fairly close touch with the part of their study concerned with communication as nursing skill. The graduate nurse students who participated were studying at the university and having field experience in a generalized hospital as part of it. They kept detailed diaries of daily patient care experiences. This included verbatim accounts of some of the conversations with patients for

whom they cared. With conscious attention they studied what the patient said and their own replies.

From subsequent discussions of the recorded conversations, it became apparent that nurses need to learn the skill of listening and to listen as nurses. Although the discussions showed intellectual acceptance of the value of encouraging expression of feeling, the students found it difficult as nurses to permit, let alone encourage, expressions of hostility or of any negative feeling when they were face to face with a patient. In fact, they shied away from any feeling which evoked uncomfortable feelings within themselves. This was not lack of concern for the patient but rather inability to allow any discussion that would interfere with the harmonious atmosphere nurses have been taught to consider essential.

One nurse, in reporting her experience with a patient, saw the problem in nursing care as one of uncooperativeness in following the physician's orders. Her real difficulty was in her effort to understand the basis for what seemed like deliberate perverse behavior. It was even more difficult for her to analyze her own feelings.

When she was asked, "Do you feel drawn to this patient?" she said "No," and, "Were you with him in your feeling?" she also replied "No." Then, when asked "Did you feel that you were against him in your feeling?" she replied, "Yes, but this is the first time I have ever looked at it this way. This is hard to face."

The process of looking objectively at one's self in a situation and gaining some understanding is indeed slow and sometimes painful. To do so requires supportive help. Perhaps this process can be illustrated best by two real situations.

### Case Illustrations

Mr. Brown was referred to a public health nursing service after his dismissal from a rather prolonged hospitalization for a heart attack. His physician requested that he be encouraged and supported in increasing activity. Mr. Brown's condition and potentialities were reviewed with the nurse. She was familiar with the philosophy that the management of a car-

diac patient is directed toward improved physiology and that therapy combines judicious use of rest, activity, and modification of diet and daily living.

The nurse found Mr. Brown's family in a flurry of excitement at having him home again. His wife and his teen-age daughter, Marjory, hovered about trying to anticipate his every need.

He protested mildly, saying, "I've been doing a lot of things for myself at the hospital, Marjory. You make me feel like an invalid."

At this point, the nurse cautioned against "too much activity" and gave approval to Marjory's doing for her father the things he had been doing for himself. Throughout that first visit, as she carried out the appropriate techniques of nursing care, she admonished Mr. Brown to be careful. As she left, he remarked, "I thought coming home was a good idea, but I'm afraid that I came home too soon."

She was uneasy about the visit. She was aware of her reluctance to encourage increased activity for Mr. Brown although she accepted, intellectually, that it was important for his recovery. Through discussion she became more aware of what had happened during her visit. She realized that she had not supported Mr. Brown's movement toward health but had actually reactivated his feeling of helplessness and dependency. She recognized that she had reinforced the anxiety of the mother and daughter. She said, "I tried to reassure them, but they seemed more worried when I left."

On being encouraged to explore her own feelings about heart disease and talk about them, she recalled an experience as a student nurse.

She told of a cardiac patient on complete bed rest who openly defied the doctor's instructions and the nurse's admonitions by occasionally getting out of bed. One day he walked out into the hall to make a telephone call and died in the booth. "It was almost as if Mr. Morris were prompting me over my shoulder to keep Mr. Brown quiet."

This is an illustration of what I mean by saying that self-awareness and insight come as the nurse works directly with patients when she is helped to recognize how her own feelings influence the care she gives the patient.

Let's take another illustration. Bob, a 15-year-old, had been in the hospital with rheumatic fever for 2 weeks and on complete bed care for that time. He often looked unhappy, and the nurses tried to cheer him up by telling him how lucky he was that his heart condition had been discovered early and that he was under such good care. He was instructed in the necessity of "being careful when he went home" and "not to overdo."

On being dismissed from the hospital, Bob was referred to a public health nursing service. The doctor wanted him to have bed rest for a time, then graduated activity. The nurse's responsibility was to demonstrate and give nursing care and to help the mother carry out the doctor's orders. After several visits, the nurse came to the supervisor with this story:

"That kid just won't pay any attention to what he's told. He gets out of bed. He doesn't want me to give him his bath. He won't pay any attention to his mother; she's getting all worn out. The doctor told the father that he would be a cardiac cripple if the situation continued. His father is irritable with the mother and impatient with the boy. The boy won't pay any attention to his father either. And the young sister—she was such a nice kid—is turning into a regular pest. The whole household is at sixes and sevens."

This was a situation in which increased understanding of the adolescent was essential, first for the nurse, and then for the family: the need of the adolescent, for example, to be self-directing and to have some part in the planning that affects him, to be considered an individual in his own right. The need of the other members of the family and the implications of the illness were reviewed. The nurse was given help in ways in which she might involve Bob and his family in plans for his care. She was supported in her work with the family, and encouraged to express and analyze her own feelings about the way Bob behaved. Open discussion gave her a better appreciation of the emotional factors in the situation.

This example is given to show how certain mental health concepts become real as the nurse is helped to make practical application in her work with families. The unhappy and re-

bellious boy who was making his illness worse became very much interested in the therapeutic regimen as he was brought into the planning and in himself had a measure of control. The nurse felt that for the first time she had seen the implication of an illness for a family in relation to herself, with its possible implications for herself. She, too, had learned a measure of control by the conscious use of self.

### In Touch With Others

With respect to freeing the potential of the nurse, it is important to emphasize the responsibility of administration for providing a setting in which quality nursing can be practiced.

Administration articulates and communicates the values in any institution or system. They may not be clearly articulated, but they will be communicated. If respect and concern for the patient is all important, that attitude will be communicated, and service, research, and training of personnel will reflect it. If, however, the development of specialized treatment is the only goal, and the patient is merely an accessory for research, that attitude, too, will be communicated. In that event, the system virtually prohibits nursing dedicated to the comprehensive care of the patient.

In addition to providing the environment for nursing care, administration has the responsibility of seeing that nursing is fully utilized in the service, research, and training activities of the institution. Though we are accustomed to think of research advances in other disciplines which may contribute to the preparation of nurses, how often do we think in terms of what nursing can contribute to other professions? The new climate in some of our teaching and research centers is making it possible to identify and describe some of the ways in which nursing can contribute to other disciplines so that they can be consciously used.

Dr. John Rose of the Philadelphia Child Guidance Center has written in an unpublished report:

"The nurse-family-child interaction is of primary importance in its own right. It is our experience, however, that the nurse is the only person who can fill certain gaps in the resident's experience." Dr. Rose was referring to his

own experience in the preparation of pediatric residents.

It is not enough to recognize that mental health is an integral part of all nursing or that the nurse should deal effectively with the emotional aspects that are a part of every situation she meets. Recognition, when we lack the knowledge and skill to function effectively, is immobilizing. The nurse must be helped in the use of self. That is her great potential.

Anne Morrow Lindbergh says it so simply for us in *Gift from the Sea* (5): "When one is a stranger to one's self, then one is estranged from others, too. If one is out of touch with one's self, then one cannot touch others."

It is our privilege to be in touch.

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## New Members of the PHR Board of Editors



Miss Arnstein



Mr. MacKenzie



Dr. Simmons

The 3 most recent appointees to the 13-member Board of Editors of *Public Health Reports* are introduced below. The new members, whose 3-year terms end in 1958, replace Dr. Justin M. Andrews, Dr. Ruth Freeman, and M. Allen Pond.

Margaret G. Arnstein, R.N., M.P.H., chief of the Division of Nursing Resources, Public Health Service, began her public health nursing career in Westchester County, N. Y. Subsequently, she served as consultant to the New York State Department of Health, first in the communicable disease field and later as district consultant for New York City. During the 3 years spent as director of the program for public health nurses at the University of Minnesota, she collaborated with Dr. Gaylord Anderson on the book "Communicable Disease Control." In charge of nursing for the UNRRA Balkan Mission, Miss Arnstein spent 15 months in the Middle East, where she organized nursing care in 2 Greek and 3 Yugoslav refugee camps and laid plans for work in the 3 Balkan countries under the mission.

Vernon G. MacKenzie is assistant chief for research and development, Division of Sanitary Engineering Services, Public Health Service.

After graduation from Massachusetts Institute of Technology in 1927, Mr. MacKenzie served 9 years in sanitary engineering research and design for the city governments of Chicago and Detroit. In the American Mission for Aid to Greece, he was deputy director of the Public Health Division. From 1948 to 1954 he was officer in charge of the Robert A. Taft Sanitary Engineering Center of the Public Health Service, Cincinnati.

Leo W. Simmons, Ph.D., is professor of sociology at Yale University, with a joint appointment in the department of psychiatry. He is also doing research under the auspices of the Russell Sage Foundation. Dr. Simmons was awarded his doctorate at Yale in 1931 and returned to the university in 1936 as a research assistant in sociology. Following field studies of the Hopi Indians in 1938 and 1941, he edited "Sun Chief," an autobiography of a Hopi Indian, 1942, and wrote "The Role of the Aged in Primitive Society," 1945. His study of the social aspects of medical care in hospital settings at Cornell Medical Center 1950-52 is reported in "Social Science in Medicine," with Harold G. Wolff as co-author.



## Health Supervision of Infants and Preschool Children

**T**HE Working Group on Service Programs of the Public Health Conference on Records and Statistics has evolved a series of suggestions pertaining to the collection, analysis, and interpretation of service statistics as tools in effective health supervision of infants and preschool children. It was necessary to limit attention to health supervision because of lack of time in which to consider such additional aspects of child health programs as pediatric clinics and care of premature infants.

The working group recognizes wide variations in program content and in stages of development and available facilities in health departments at all levels, and considers that changing concepts and new approaches are vital to the attainment of goals in public health work. Prescribing specific statistical patterns

which would be applicable to all health departments was considered neither desirable nor possible. Consequently, the proposals of the working group should be regarded as a framework within which each health department may develop a statistical program in accordance with its own desires.

### Prerequisites to accumulation of meaningful statistics

The following conditions must exist if meaningful service statistics are to be developed:

1. The objectives and scope of the program must be clearly defined.

2. Statisticians and program personnel such as physicians, nurses, nutritionists, social workers, and health educators should have a part in determining the kinds of information needed and in developing plans for its collection. The statistician should function as a member of the professional team in initial planning of the program as well as in program operation and evaluation.

3. The purposes to be served by statistical data should be clearly specified. Reports should be prepared only to fulfill specific purposes.

4. Provision should be made in advance, during the initial planning stage, for periodic evaluation of statistical procedures.

5. Statistics developed for health supervision of infants and preschool children should be correlated with statistics developed for related programs of the health department. One

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*This is the second in a series of statements developed by the Working Group on Service Programs, originally named the Working Group on Service Statistics, of the Public Health Conference on Records and Statistics. In arriving at the conclusions embodied herein, the working group had the benefit of consultation with Dr. Martha Clifford, director of the bureau of maternal and child hygiene, Connecticut State Department of Health. The first statement was an outline of basic principles governing service statistics in public health, which appeared in the June 1956 issue of Public Health Reports, p. 520.*

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means toward this end is to have a records committee periodically pass on and review basic statistical forms of the several programs.

### Kinds of information necessary for effective operation of service

Information desirable for operation of effective health supervision of infants and preschool children is of three main types:

1. Baseline data should be used for determining overall needs and for evaluating completeness of service. According to the definition developed by the working group, these baseline data are not included as service statistics. It should be emphasized that service statistics are most valuable when related to baseline data. The working group considered it appropriate to cite a few examples of baseline data useful for the planning and evaluation of infant and preschool health services: live births, by geographic area; infant and preschool deaths, by cause; illnesses reported, by cause; births occurring at home; economic status of population, by geographic area; racial characteristics of population, by geographic area; availability of private and voluntary medical and allied personnel, facilities, and services; and resources of the health department.

2. The second type of information is that which would assist physicians, nurses, and other health department persons primarily in giving service to individual infants and preschool children. The kinds of information listed below outline valuable statistics for operating an effective health program:

- Total number of individual children served by the health department (unduplicated count) distributed by geographic area, new cases and old cases, and characteristics of children served (age, sex, color).

- Volume of service (number of visits).

- Type of service, for example, physical examination, dental services, immunization, parent counseling, referrals to other medical services, and results of referrals.

- Site of service, for example, child health conference, home visits, and immunization center.

In order to obtain this information, the following types of data should be routinely available regarding each child served by the health

department: date of birth, sex, and race of child; geographic area in which child resides; date of admission to service; number of time served by the health department, in the home and in child health conferences; kinds of services received from the health department.

Individual health departments should develop applications of the statistics outlined above in combination with each other to meet the needs of their own programs. Examples are number of children immunized, by age; types of service given to new as compared with old cases; and volume of service by site of service. Such data may be compiled either routinely or through special studies.

3. Then, there are the kinds of information that would assist program administrators primarily in analyzing the operation of their programs. Types of data regarding operation of the program, which should be available either routinely or through special studies are these:

- Total attendance, by age group and status (new or old patient) of children, at each clinic or conference, and personnel time involved. For example, reports of clinic attendance might suggest changes in clinic policy, dates, hours, or location in order to adjust services to needs. Also, effectiveness of home nursing visits might be evaluated. Total clinic visits related to physician time can be used to evaluate clinic policies.

- Incomplete services indicated by number of children previously under care but not given service over a certain length of time; percentage of children with broken appointments; number of cases with undue waiting time between appointments; number of children who have not been vaccinated or immunized; and failures to respond to recommendations. This information may be used for evaluation of general performance and policy.

- Summary of program activity, for evaluating personnel needs of a program, and for justifying specific types of expenditures.

- Clinics in operation in relation to economic status of geographic areas.

### Techniques for collection, tabulation, analysis, and interpretation of information

*Source documents.* Information for service statistics may be obtained from conference or



clinic attendance records, basic family unit records, individual case records, tickler cards, nurses' daily activity reports, and the like.

*Methods of tabulation.* Service statistics may be tabulated by:

1. Manual methods—These methods of abstracting information by manual sorting and counting up individual case summary cards, or tally sheets, are applicable in small health departments.

2. Marginal-punched, hand-sort cards—This method permits ready analysis where the volume of service is not large enough to justify mechanical tabulation.

3. Mechanical tabulation—This method is practical in health departments with a large volume of services.

*Frequency of compilation.* The frequency with which specific reports should be compiled must be determined locally depending on uses to be made of the data. Unduplicated counts of individuals served should be tabulated annually on a calendar-year basis and more often if needed.

Compilation of all service statistics on a calendar-year basis is recommended for comparison with baseline data. Where these statistics are required for fiscal purposes, compilation on a fiscal-year basis should supplement, but not substitute for, calendar-year data. The working group cautions against more frequent tabulations than are justified by use.

*Special studies.* Special studies are useful tools in program evaluation. They are recommended as a device to reduce the number and complexity of routine reports wherever possible. Routine reports should concentrate on minimum essentials for reflecting program, avoiding over-refinement of data.

Some types of service statistics which might be obtained through special studies are determination of levels of immunizations, evaluation of specific new services or program techniques (for instance, triple antigen, administration of vitamins), changes in behavior resulting from health department activity, determining reasons for lapses in attendance at child health conferences or for failures to complete immunizations, comparison of effectiveness of individual interviews and group conferences, and time and cost studies.

*Methods of interpretation and presentation.* The mere tabulation of data does not in itself provide for maximum utilization of service statistics. There should be a team approach in planning summary tables, narrative analyses, graphic presentation, trend data, and how and when the collected data are to be used.

Statistical measurements of service should be interpreted in relation to baseline data, needs for services, and program objectives. Only thus can an approach be made to evaluating accomplishments of programs.

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*The statement has been reproduced in mimeographed form as attachment A to document 229 by the National Office of Vital Statistics, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C.*

*Under the title, "A Guide for the Collection, Analysis, and Interpretation of Service Statistics in Health Supervision of Infants and Pre-school Children," it has the endorsement of the following organizations: Association of State and Territorial Directors of Local Health Services; Council of State Directors of Public Health Nursing; and the Statistics Section, and Committee on Administrative Practice, American Public Health Association.*



*Comparative biochemical studies and counts of suspended algae and protozoa in a small Ohio stream give evidence that the effluent from a small sewage treatment plant characteristically causes an increase in certain green flagellates (Euglenophyceae) and the disappearance of the yellow brown flagellates (Chrysophyceae).*

## Stream Enrichment and Microbiota

By JAMES B. LACKEY, Ph.D.

IT has been well demonstrated that one ultimate effect of sewage or of treated sewage effluents is the fertilization of the receiving stream or body of water (1-7). This generalization, however, is seldom based on actual counts of species and of their numbers in the receiving waters. It is usually based on a study of a few kinds of organisms or of a broad classification, such as green flagellates. In the few instances in which the actual numbers and kinds of species occurring below points of waste or sewage admission have been studied (1, 4, 8, 9), no companion studies have been undertaken on nearby and somewhat similar waters as controls.

To provide more specific information on the fertilizing effects of a treated sewage effluent, an ecologic study of the suspended microbiota in Lytle Creek, a small stream in southwestern Ohio which receives such an effluent, was begun in the summer of 1944. In this study, the qualitative and quantitative distributions of the suspended algae and protozoa at points selected

to reflect the effects of the effluent were determined. For comparison with Lytle Creek, similar studies were made of Cowan Creek, an unfertilized stream in the same area, and of the Santa Fe River, a larger unfertilized stream in Florida. The findings of these studies are presented in the following pages.

Lytle Creek has been the scene of three earlier reports. Gaufin and Tarzwell (10) have described the known invertebrates (exclusive of protozoa); Cooke (11) has considered the ecology of the fungi; and Katz and Gaufin (12) have discussed the fish. These papers, together with the present one, give an account of the majority of the living organisms in Lytle Creek and provide what is perhaps the most nearly complete story of one stream.

### The Ohio Streams

Lytle Creek is about 11 miles long. In the summer of 1944, when it was sampled for this study, it had a flow of about 1 cubic foot per second except after showers. The stream drained a small rural farming section and received the effluent from the sewage treatment plant for Wilmington, Ohio, a town of about 6,000 population (1940 census). The sewage effluent was the only pollution entering the stream. The stream showed a typical oxygen depletion just below the treatment plant outfall, with recovery before it entered Todd Fork about

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7 miles away. Typical dissolved oxygen ranges, pH values, and temperatures in Lytle Creek are given in the paper by Gaufin and Tarzwell (10) or the one by Cooke (11). Although the work reported in this paper antedates theirs, conditions were probably very similar.

Cowan Creek is located in an adjoining watershed and is similar in length and flow. However, its watershed, which is arable, pasture, or wooded land, is sparsely inhabited, and the stream receives no visible pollution. According to samples from one point, biochemical oxygen demand (BOD), the dissolved oxygen, and the nitrate content corresponded roughly to station V on Lytle Creek.

### *Sampling Procedures*

Samples from Lytle Creek were taken at five stations, which had been set up for a study conducted by the Public Health Service. Their locations are shown in figure 1. Station I, at mile 8.7 above the mouth of the creek, was within the city limits of Wilmington. Station II, at mile 7.2, was a short distance below the outfall of the sewage treatment plant. Station III was at mile 5.2, where there was little visible evidence of the sewage effluent, and stations IV and V were at miles 3.2 and 1.0, respectively,

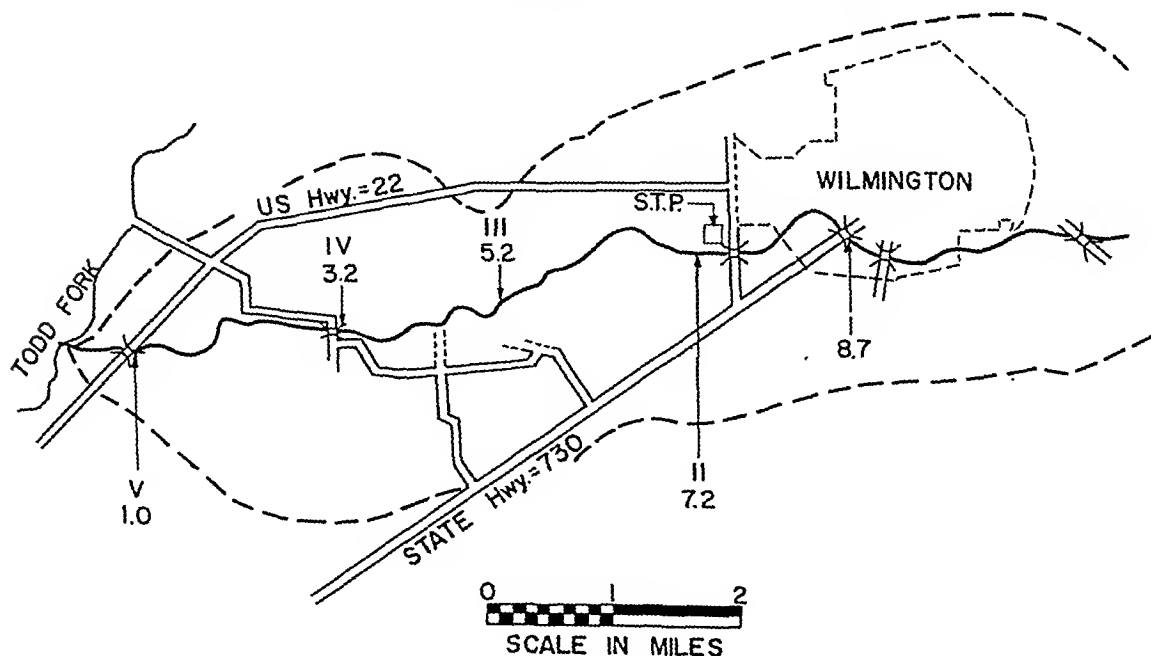
where the stream presented a practically normal appearance. Samples from Cowan Creek were taken at only one point, which corresponded in mileage from the mouth to Lytle Creek V.

These two streams were sampled approximately every 2 weeks beginning June 19 and ending August 15. The samples, totaling 33, were brought to the stream pollution investigation station at the Environmental Health Center (now the Robert A. Taft Sanitary Engineering Center), Public Health Service, and there analyzed for kinds and numbers of organisms and certain biochemical data. The sampling period covered the time of low flow and high temperature, when populations of algae and protozoa are normally at their highest. Practically every organism found had been recorded previously from other Ohio River Basin streams.

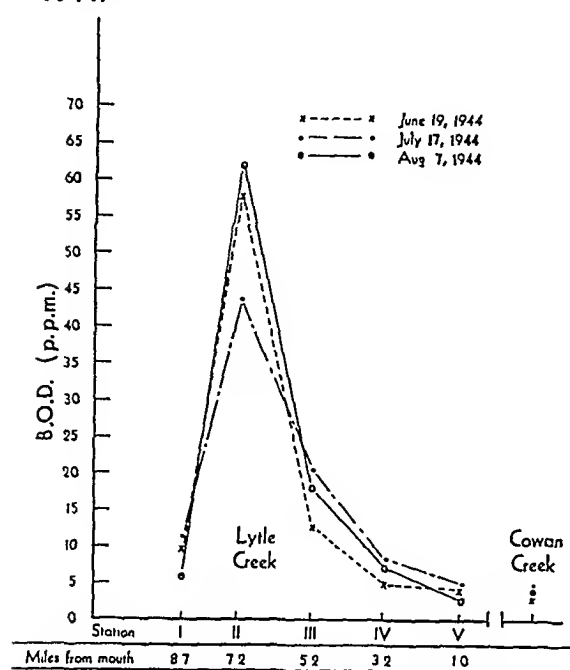
### *Results*

The BOD values for Lytle and Cowan Creeks are shown in figure 2. The BOD figure of about 4 p.p.m. for Cowan Creek is close to the average for unpolluted creeks of this area that have been sampled. It is not surprising that the BOD value was so high at station II on Lytle Creek, since the dilution of the treatment plant effluent was not large. Perhaps the most sur-

Figure 1. Location of sampling stations in Lytle Creek.



**Figure 2. Range in biochemical oxygen demand (BOD) in Lytle and Cowan Creeks, summer of 1944.**



prising thing about the BOD values is the rapid decrease at the downstream stations.

The BOD values accord well with the values for nitrates and nitrites, shown in table 1. All three values, decreasing rapidly downstream, argue for large numbers of organisms, both saprophytic and holophytic (or saprozoic and holozoic), moving downstream.

A total of 167 species or genera of algae and protozoa were found in the 27 samples from Lytle Creek. In the 6 samples from the single Cowan Creek station, 92 species or genera were found. Table 2 lists all the species and gives the number of occurrences of each, by station.

Station I on Lytle Creek, the clean water station, had a total of 101 species, which occurred 195 times in the samples analyzed. These should have provided an excellent seeding for the downstream stations, if they were able to pass through the short zone of oxygen depletion, or possibly toxic zone, just below the treatment plant outfall. Forty-three of these species were found at station II. All of the Chrysophyceae and most of the Cryptophyceae, the Volvocales, and the diatoms (Bacillariaceae) were killed in the zone of pollution, but the remaining groups, which recovered only slightly

in species, recovered surprisingly in numbers of organisms.

The number of species found at station I in Lytle Creek was never again equaled. The only group showing a downstream increase in species was the green Euglenophyceae. Station V, the lowest on Lytle Creek, showed 20 fewer species than the comparable Cowan Creek station, which had 9 fewer species than the uppermost Lytle Creek station. Eleven of the twelve species of Chrysophyceae found in Cowan Creek were found not at all in Lytle Creek after station I: Evidently this group will not stand recent sewage pollution. Even some of the blue-green algae disappeared. Other groups adversely affected at stations II, III, and IV were the Cryptophyceae, the Dinoflagellata, the Volvocales, the Chlorophyceae (which die rather slowly in polluted water), and the diatoms.

However, the downstream decrease in number of species was compensated for by the increase in number of organisms. If 500 organisms of one species per milliliter is accepted as a bloom value (13), there were from 2 to 6 blooms at the downstream stations as compared with one bloom at station I and no blooms at the Cowan Creek station:

	Blooms in Lytle Creek				
	I	II	III	IV	V
<i>Chromatium</i> sp	-----	-----	-----	648	512
<i>Cryptomonas</i>	-----	-----	-----	-----	1,100
<i>crocosa</i>	888	-----	-----	-----	15,040
<i>Navicula</i> spp	-----	{ 800	{ 660	2,640	512
		{ 1,120	{ 680		
			{ 568		
			{ 800		
<i>Trachelomonas</i>	-----	-----	-----	-----	640
<i>urceolata</i>	-----	-----	-----	-----	5,760
<i>Euglena</i> sp	-----	{ 784	-----	-----	-----
		{ 504	-----	-----	-----

**Table 1. Nitrate and nitrite nitrogen at six sampling points in Lytle and Cowan Creeks, July 24, 1944**

Station	Nitrate nitrogen (p.p.m.)	Nitrite nitrogen (p.p.m.)
Lytle Creek		
I	0.10	0.01
II	.44	.02
III	.80	.08
IV	.08	trace
V	.08	trace
Cowan Creek	.04	trace

Table 2. Micro-organisms found in Lytle and Cowan Creeks in the summer of 1944: number of occurrences of each species at each station sampled

Genus and species	Lytle Creek					Cowan Creek
	I	II	III	IV	V	
SCHIZOMYCETES						
Beggiotoa alba	1			4		
Blastocaulis sp.			1	3	1	
Chromatium sp.		1		1		
Sphocrotilus natans				1	2	
Spirillum spp.	1					
Spirochaeta sp.	1		1			
MYXOPHYCEAE						
Aphanocapsa sp.		1				
Chroococcus turgidus	2					
Lyngbya sp.	1		1	2	1	
Merismopedia elegans	2	2				1
Merismopedia glauca	2				1	
Oscillatoria spp.	3	3	5	4	3	3
Phormidium sp.	2					
CRYPTOPHYCEAE						
Chilomonas paramecium	1				1	
Chroomonas spp.	3	1	2		2	4
Cryptomonas ovata					1	1
Cryptomonas spp. (including erosa)	6	5	3	1	5	6
Cyathomonas truncata	2					1
Rhodomonas lacustris	2		2			3
CHRYSPHYCEAE						
Chromulina globosa	1					3
Chromulina ovolis	2					3
Chromulina pascheri						1
Chrysopsis sagene						2
Chrysococcus asper						2
Chrysococcus ovalis						2
Chrysococcus rufescens						2
Chrysococcus spirale						3
Dinobryon sertularia						1
Mallomonas tonsurata		1				1
Mallomonas sp.						1
Rhizochrysis scherffeli						
DINOFAGELLATA						
Gymnodinium gracilis	1					2
Gymnodinium sp.					2	
Peridinium tubulatum						1
VOLVOCALES						
Brachiomonas sp.				1		
Carteria elongata	1					
Cephalomonas granulata	3					5
Chlamydomonas spp.	6	6	5	5	4	
Chlorogonium minimum						1
Gonium pectorale						1
Heteromastix angulosa	2	2	1	1	1	1
Lobomonas rostrato						1
Pandorina morum						
Pedinomonas rotunda	1					4
Phacotus angulosa			1			
Phacotus lenticularis	4			1	1	1
Pyramidomonas inconstans	2				1	3
Scherffelia phacus					1	
Spermatozopsis exultans						4
Spondylomorom quaternarium			1		4	
Thoracomonas sp.						2

Genus and species	Lytle Creek					Cowan Creek
	I	II	III	IV	V	
VOLVOCALES--Continued						
Colledictyon triciliatum	2	4	3		2	1
Polytoma uvella		1		4		
BACILLARIEAE						
Achnanthes coarctata	4		1			
Cocconeis placentula	3	3	1	1	1	
Cyclotella meneghiniana	6	5	2	1	1	3
Cymbella sp.	3				1	2
Diploneis sp.			1			
Eunotia sp.	2	1				2
Fragilaria crotonensis						1
Fragilaria sp.	1			1		1
Gomphonema olivaceum		1	2			
Gyrosigma sp.	1	1				5
Melosira granulata	1					
Melosira varians						1
Navicula spp.	6	6	5	3	5	6
Nitzschia closterium	1			2	1	2
Nitzschia sigmaidea	1				1	1
Pinnularia sp.	1		2	1	2	
Rhizosolenia eriensis						1
Rhoicosphenia sp.		1				
Surirella sp.		1		1		2
Synedra acus						2
Synedra biceps	1					1
Synedra ulna	1	1	2		2	3
Synedra sp.	2	1	2	2		3
EUGLENOPHYCEAE (green)						
Cryptoglena pigra		1	1	1	1	
Euglena acus	3	6	4	1	3	3
Eugleno agilis		1	1	1	1	1
Euglena anabaena	1	1	1	1		
Euglena deses		3	5	3	1	1
Euglena ehrenbergii		3			1	
Euglena fusca	1	1		1		
Euglena gracilis			1	1	2	
Euglena granulata	1	3	1	2	1	
Euglena oxyuris	1	4	3		2	
Euglena pisciformis	2	4	4	3	4	1
Euglena polymorpha	2	5	3	3	3	
Euglena quartana				4		
Euglena sanguinea		1	1			
Euglena sciotoensis	1	2	1	1	1	2
Euglena spirogyra			1		1	1
Euglena tripteris		1				
Euglena viridis	4	6	2	4	3	1
Euglena sp.	4	6	5	4	5	2
Lepocinclis marssonii	1	4	2	1	1	2
Lepocinclis ovum	2	5	3	1	3	3
Lepocinclis steinii		1				
Lepocinclis texta		3	2			
Phacus anacoleus		2	2	1	1	
Phacus brevicauda		3	1			
Phacus longicauda					1	
Phacus pleuronectes		2	3	3		1
Phacus pyrum		3	3	2	1	
Phacus stokesi		3	2			
Phacus suecica		1				1
Phacus triquetus		2	2	1		
Phacus sp.			1			
Trachelomonas crebca						2
Trachelomonas hispida		1				1

Table 2. Micro-organisms found in Lytle and Cowan Creeks in the summer of 1944: number occurrences of each species at each station sampled—Continued

Genus and species																			
Lytle Creek					Cowan Creek	Genus and species													
I	II	III	IV	V		I	II	III	IV	V	Cowan Creek								
EUGLENOPHYCEAE—Con. (green)																			
<i>Trachlomonas stokesi</i> .....			1	1	2		<i>Balanitozoon agilis</i> .....					1							
<i>Trachlomonas teres</i> .....	1					3	<i>Chilodonella cucullulus</i> .....	2				1							
<i>Trachlomonas urceolata</i> .....	1	5	1	1	5	2	<i>Cinctochilum margaritaceum</i> .....					1							
<i>Trachlomonas volvocina</i> .....	2	1	1	1	3	3	<i>Coleps hirtus</i> .....	3											
EUGLENOPHYCEAE (colorless)																			
<i>Anisonema ovalc</i> .....	1				1		<i>Colpidium colpoda</i> .....		2	2	1								
<i>Astasia klebsii</i> .....		1		3	1		<i>Cyclidium glaucoma</i> .....	2	3	3	1	1	2						
<i>Copromonas subtilis</i> .....				1			<i>Cyclidium spp.</i> .....		1			1							
<i>Distigma proleus</i> .....	1						<i>Glaucoma pyriformis</i> .....		1										
<i>Entosiphon sulcatum</i> .....	2						<i>Halteria grandinella</i> .....		1			2							
<i>Menoidium incurvum</i> .....	1	1	1	2			<i>Holophrya viridis</i> .....				1								
<i>Metanema sp.</i> .....	1						<i>Lembadion bullinum</i> .....						1						
<i>Notosolenus apocamptus</i> .....			1				<i>Lionotus fasciola</i> .....	1											
<i>Peranema trichophorum</i> .....	1	1	1			1	<i>Microthorax sulcatus</i> .....	3											
<i>Petalomonas angusta</i> .....					1		<i>Pleuronema chrysalis</i> .....				1								
<i>Petalomonas carinata</i> .....				1			<i>Strobilidium sp.</i> .....	1			2	2							
<i>Sphenomonas quadrangularis</i> .....				1			<i>Trachloerca phoenicopleurus</i> .....	1											
	3	4	1				<i>Uronema marina</i> .....				1								
							<i>Urotricha farcta</i> .....	2	3	1	1	2	2						
							<i>Vorticella spp.</i> .....	1		2	1								
CHLOROPHYCEAE																			
<i>Actinastrum gracillimum</i> .....					2		<i>Actinophrys sol.</i> .....	1											
<i>Ankistrodesmus falcatus</i> .....		3			2		<i>Amoeba vespertilio</i> .....		1										
<i>Ankistrodesmus convolutus</i> .....				1			<i>Amoebulae</i> .....					1							
<i>Ankistrodesmus mirabilis</i> .....	4	4	1	2	4		<i>Hartmanella hyalina</i> .....				3								
<i>Ankistrodesmus tumidus</i> .....	2	2	1	1			<i>Microgromia sp.</i> .....			1									
<i>Chlorocella spp.</i> .....		1					<i>Nuclearia delicatula</i> .....	2											
<i>Closterium sp.</i> .....	1						<i>Rhaphidiophrys elegans</i> .....	1			1								
<i>Coclastrum microporum</i> .....	2				1		<i>Rhaphidiophrys pallida</i> .....	2			1		1						
<i>Coelastrum reticulatum</i> .....	1			2			<i>Vahlkampffia albidula</i> .....		1										
<i>Cosmarium sp.</i> .....	4	2			1	1	<i>Vahlkampffia limax</i> .....					1							
<i>Desmatractum sp.</i> .....						1	<i>Vampyrella sp.</i> .....	1											
<i>Kirchneriella lunaris</i> .....	2		1		1														
<i>Lagerheimia chodatii</i> .....	1						MASTIGOPHORA												
<i>Micractinium pusillum</i> .....		1			1		<i>Bodo caudatus</i> .....		1		2								
<i>Oocystis lacustris</i> .....	2	1	1				<i>Bodo pulcher</i> <sup>1</sup> .....	1	2	2	1	1							
<i>Pediastrum duplex</i> .....	1			1			<i>Dinomonas vorax</i> .....						2						
<i>Pediastrum boryanum</i> .....	3		1				<i>Oicomonas socialis</i> .....	1					1						
<i>Pediastrum tetras</i> .....	3						<i>Oicomonas termo</i> .....	2	1	2	1	2	1						
<i>Schizochlamys gelatinosa</i> .....	1								1										
<i>Schroederia setigera</i> .....		1							1				1						
<i>Selenastrum gracile</i> .....	4	3					<i>Pleuromonas jaculans</i> .....	1	1										
<i>Scenedesmus spp.</i> .....	4			2	3		<i>Pteridomonas pulex</i> .....	2					1						
<i>Tetrademus wisconsinensis</i> .....	1						<i>Spiromonas angusta</i> .....	1											
<i>Tetracodon minutum</i> .....	1				1		<i>Unidentified colorless flagellates</i> .....	4	2	2	2	2	3						
<i>Tetracodon muticum</i> .....				1															
<i>Tetralantos lagerheimii</i> .....	1																		
<i>Treubaria triappendiculata</i> .....																			
<i>Westella botryoides</i> .....	1	1			1														
Unidentified green cells.....		1																	
Total number of species or genera.....								101	82	68	63	72	92						

<sup>1</sup> Provisional name only.

The numbers of blooms at the downstream stations in comparison with the numbers at station I and in Cowan Creek are one evidence of enrichment. Further evidence is afforded by a comparison of the total number of organisms at each station. The numbers of organisms at sta-

tions II through V were much greater than the numbers at station I and in Cowan Creek, as shown in table 3. It should be noted, too, that only 5 samples were analyzed for each of the lower three stations, as compared with 6 for each of the others.

Actually, the fertilization of the downstream waters is apparent, on the basis of a marked increase in the number of organisms, for only a few groups. The blue-green algae were up sharply at station III, but they declined thereafter. The Cryptophyceae first dropped sharply, then rose to high numbers at station V. This pattern is a common occurrence for the Cryptophyceae. They apparently are favorably influenced by recent fertilization, but they seem to avoid high BOD values. The same is true of the small colorless flagellates, whose behavior in a stream seems to differ from their behavior in a sewage treatment plant. This difference, however, may be a sampling fault, since most of these organisms occur on or near the bottom.

Some of the data in table 3 are very difficult to explain. For example, the number of ciliates dropped steadily until station V, where there was suddenly a fourfold increase. This increase, however, was due almost entirely to *Balanitozoon agilis* and *Urotricha faretta*, two related ciliates whose food is largely unknown. These might have been feeding on some small bacteria that develop late in the cycle of organic degradation. Just how far we are from being able to foretell, or account for, the presence of a given organism in a stream is emphasized in a

recent paper by Wuhrmann (14). He showed an inability to produce a given biota in effluents similar as to BOD, oxygen consumed, nitrate content, and so on. He concluded that there were still unknown organic substances present that determine the nature of the biota.

The Euglenophyceae, however, clearly demonstrate the effects of stream enrichment. They were the largest group in number of species at each station, but they were low in number of organisms at the Cowan Creek station and Lytle Creek I. At Lytle Creek V they were more abundant than any other group, except for the single bloom of *Cryptomonas erosa* that occurred there. The Euglenophyceae showed substantial increases at stations II, III, IV, and V, and they were the most abundant group at station II. At station III, only diatoms and small green cells (*Chlorella*) outnumbered them; at station IV, only diatoms.

Use of the whole group of Euglenophyceae as indicators of pollution or of recent pollution has been questioned (14).

In the present study, the genera *Cryptoglena*, *Euglena*, *Lepocinclis*, and *Phacus* were found to be well represented in the enriched or recently polluted water; and many of the species not only tolerated the condition, they multiplied in it. Most of the species of these four genera that

Table 3. Total number of organisms<sup>1</sup> in all samples by station

Group	Lytle Creek					Cowan Creek (6 S)
	I (6 S)	II (6 S)	III (5 S)	IV (5 S)	V (5 S)	
Schizomycetes.....	92	224	4	1,337	7	0
Myxophyceae.....	174	148	263	162	108	30
Chrysophyceae.....	16	0	0	0	1	1,742
Cryptophyceae.....	1,029	441	31	168	16,778	434
Bacillariace.....	1,370	3,217	3,329	2,690	797	1,198
Volvocales.....	817	860	668	733	607	561
Euglenophyceae (green).....	306	3,633	1,436	2,617	10,539	161
Euglenophyceae (colorless).....	10	16	41	16	17	11
Chlorophyceae.....	664	723	7,086	0	5,253	212
Ciliata.....	46	35	10	9	194	20
Rhizopoda.....	20	6	1	23	17	3
Mastigophora.....	764	140	124	197	7,830	122
Total.....	4,925	9,443	11,845	8,071	42,287	4,494

S=Samples.

<sup>1</sup> An organism in this paper usually means a single cell. Exceptions include filaments whose cells are distinguished with difficulty (such as *Beggiatoa* and *Lyngbya*) and some colonies (such as *Aphanocapsa*, *Spondylomorom*, and *Coclastrum*).

Table 4. Total number of *Trachelomonas* organisms in all samples, by station

Species	Lytle Creek					Cowan Creek
	I	II	III	IV	V	
<i>Trachelomonas erceba</i> .....	0	0	0	0	0	7
<i>Trachelomonas hispida</i> .....	0	2	0	0	0	1
<i>Trachelomonas stokesii</i> .....	0	0	1	1	96	0
<i>Trachelomonas teres</i> .....	1	0	0	0	0	36
<i>Trachelomonas urceolata</i> .....	2	364	8	32	1,092	54
<i>Trachelomonas volvocina</i> .....	36	2	8	8	648	12
Total.....	39	368	17	41	1,836	110

were found occurred at or below station II in Lytle Creek, and most of the occurrences of these genera were in the polluted or recovery areas.

The genus *Trachelomonas* offers a different story. It was represented by only 6 of its many species, and only 1 of these 6, *urceolata*, increased markedly in the area of pollution, as shown in table 4. This is in decided contrast to the genus *Euglena*, which was represented by 18 species. Table 5 shows the behavior of the nine most common of these. All achieved substantial to large increases at stations II, III, and IV. All except *Euglena quartana*, which is a saprophyte, were present either in Cowan Creek or Lytle Creek I but in very small numbers.

Actually, then, the occurrence of many of the Euglenophyceae was favored by existing or recent sewage pollution, and there were a few species, such as *Euglena acus*, *E. agilis*, *E. pisciformis*, *E. polymorpha*, *E. gracilis*, and *E. quartana*, *Lepocinclis ovum*, and *Trachelomonas urceolata*, which showed heavy increases as a result of such pollution. These same species may bloom for other reasons, of course.

A few other organisms, such as *Oicomonas termo* and *Chlorella* spp., certain chlamydomonads, and navicloid diatoms, behaved in the same manner. On the whole, however, it is easier to list the organisms that died as a result of the pollution. Here special emphasis would be on the Chrysophyceae or the Chlorophyceae. Perhaps analysis of a much larger number of samples would show some additional species to be favorably influenced by the pollution.

One species not identified in samples from other Ohio Valley streams was found in this study. This was *Cephalomonas granulosa*, one of the Volvocales, which is apparently rare. It occurred in Cowan Creek once, at Lytle Creek I three times, and at Lytle Creek V once. No significance can be attached to these occurrences, although there were 216 organisms per milliliter in Lytle Creek I in one sample.

#### Comparison With a Florida Stream

It may be argued that the numbers of organisms in Lytle Creek are not unusual and therefore do not support the idea that heavy growths follow enrichment. Cowan Creek, which was used as a control, was fairly similar to Lytle Creek chemically and biologically. For a comparison with a stream having different characteristics, the Santa Fe River in north central Florida was selected.

No data on BOD, nitrates, nitrites, or phosphorus for the Santa Fe River are available. However, it received virtually no sewage or industrial pollution and probably little agricultural drainage. The Santa Fe differs from Ohio Valley streams in that it is a brown-water (tannic and perhaps humic acid) stream with a pH tending toward acidity.

The Santa Fe River and two small lakes that contribute to the headwaters of the river were routinely sampled in 1953-54. A total of 81 samples from six points in the river and one point in each of the lakes were analyzed for kinds and numbers of organisms. In these 81 samples, 332 species or genera of algae and protozoa were found. Roughly, this is two



times as many species in three times as many samples as were found in Lytle Creek. The groups of organisms found in the Santa Fe system, by station, are shown in table 6. It is evident from this table and from table 2 that routine sampling of any body of water of fair size will reveal a large variety of algae and protozoa, unless there is some special restrictive reason such as extreme pollution.

At one river station, Mikeville, cattle used the small slough-like branch of the river proper, and this water was at times polluted. The pollution was evidently mild, however. Forty-three of the forty-seven observed species of Euglenophyceae occurred at this station, but

none of them ever attained bloom proportions.

There were only three blooms in the river during the time it was studied. All three were at Mikeville: one of a species of *Gymnodinium*, one of *Ankistrodesmus falcatus*, and one of the minute green *Chlorella*. Hampton Lake had three blooms, and Santa Fe Lake had eight. Of the latter, four were late summer blooms of blue-green algae, quite in keeping with lake behavior. The bloom organisms did not enter the river to any extent because the very small amount of water draining from the lakes passes through marshy, grass-grown channels.

The Santa Fe, then, is a largely unpolluted stream that is rich in kinds of algae and pro-

Table 5. Total number of certain *Euglena* organisms in all samples, by station

Species	Lytle Creek					Cowan Creek
	I	II	III	IV	V	
<i>Euglena acus</i> .....	29	445	307	520	648	13
<i>Euglena agilis</i> .....	0	24	4	1	64	1
<i>Euglena deses</i> .....	0	4	22	13	8	1
<i>Euglena pisciformis</i> .....	82	60	461	279	85	1
<i>Euglena polymorpha</i> .....	24	102	40	145	532	1
<i>Euglena quartana</i> .....	0	0	0	709	0	0
<i>Euglena sciolfensis</i> .....	2	42	2	36	16	3
<i>Euglena viridis</i> .....	14	260	5	256	297	1
Other species (mostly <i>Euglena gracilis</i> ).....	25	1,904	115	620	6,530	25
Total.....	176	2,841	1,356	2,559	8,180	46

Table 6. Number of species in principal groups of algae and protozoa occurring in 81 samples from the Santa Fe River system, Fla., 1953-54

Group	Santa Fe Lake (12 S)	Hampton Lake (5 S)	Waldo (12 S)	Worthington Springs (10 S)	Mikeville (9 S)	Oleno (13 S)	High Springs (11 S)	Bell (9 S)
Schizomycetes.....					1	1		
Myxophyceae.....	11	6	4	4	13	6	5	6
Chlorophyceae:								
Volvocales.....	3	3	1	3	13	6	3	7
Other.....	30	25	7	10	53	13	4	13
Xanthophyceae.....	1	2	1	0	5	1	0	1
Chrysophyceae.....	6	4	5	5	5	4	3	1
Cryptophyceae.....	3	2	5	3	5	2	3	3
Dinoflagellata.....	7	9	1	5	8	5	2	3
Euglenophyceae.....	4	1	0	12	43	15	12	4
Bacillariaceae.....	16	7	11	22	16	25	21	21
Mastigophora.....	4	2	6	1	13	3	7	2
Rhizopoda.....	3	1	7	7	17	3	5	5
Ciliata.....	17	3	8	7	17	6	8	6
Totalspecies.....	105	65	56	79	219	90	73	72

S=samples.

tozoa, but poor in numbers of organisms. It contained many organisms common to Lytle Creek, and the increase in kind and number of organisms at the Mikeville station indicates that it might well exhibit blooming if well fertilized. These observations strengthen the idea that plentiful enrichment of a stream causes a great increase in organisms, and also that the kind of bloom is a function of the type of enrichment. At Mikeville, where the water was muddied by cattle and polluted by their droppings, a sharp and heavy increase in Euglenophyceae occurred. This fact and the Lytle Creek study both indicate that some Euglenophyceae increase as a result of fecal pollution.

### Bloom Potentials

A plentiful supply of the proper nutrients is certainly essential for blooming. That the nature of the nutrient material determines both the strength and nature of blooming has been indicated by a number of observations. In the laboratory at the University of Florida, for example, commercial fertilizer has been repeatedly added to concrete tanks that are filled with water from a small brook. The brook is spring-fed but it contains a varied plankton, including Euglenophyceae. These tanks develop heavy blooms—of small Chlorophyceae. A few *Euglena*, *Phacus*, and *Lepocinclis* organisms occur in the bloom, but their numbers are always small. As another example, never in any pond I have observed has the addition of commercial fertilizer produced a bloom of *Euglena sanguinea*; but when similar ponds are invaded by cattle this organism frequently blooms heavily.

In addition to the proper nutrients, the proper seed must be present. Few protozoa or algae, however rare they may be, seem likely to be absent in most environments. There are broad limits—acid water vs. hard; low salinity vs. high—for certain species or groups. *Gonyostomum semen* is practically never found in hard water, and *Gymnodinium brevis* has never been recorded from any part of the world other than the Gulf of Mexico off the Florida coast and Trinidad, B. W. I. (16). Instances such as these are rare, however, and probably would be greatly decreased by additional and much

more critical observation in many parts of the world. In almost every instance in which a single group of organisms has been studied extensively in a particular geographic area, investigators have found most of the known species of that group (within their broad ecologic limits). A recent example of this is the study by Decloitre (17) of the thecate rhizopods in French Equatorial Africa. He found most of the known species. He recognized climate as a barrier for some species, but also stated: "The intertropical zone is little known as a whole; it is very probable that a certain number of these species will be found, sooner or later, in this climatic zone and will be recognized as ubiquitous."

It is unwise to state that a micro-organism species—that is, the seed—is absent from a given environment. One reason is that the environment may not have been adequately sampled; another is that the sample may not have been completely analyzed. It is difficult to examine completely even a single drop of water in a sample. Many workers make one examination, then set the slide aside in a moist chamber to reexamine later. The question inevitably arises as to what size sample must be analyzed to yield a given species. Or otherwise stated, what is the chance of finding a given species in a random sample?

Fisher, Corbett, and Williams (18) consider that the majority of species are rare, only a few being common. Therefore, the species in a biological group would not be equally abundant, even though an environment might be sampled a number of times under uniform conditions. This is equivalent to stating that conditions in the habitat sampled were optimal or nearly so for the "common" species, but only within the range of tolerance for those that occurred less frequently. I do not recall ever having seen *Trachelomonas reticulata* but once, despite having examined thousands of samples of foul water, presumably its preferred habitat. This one occasion was a sample from a tree hole, and it contained a dense population of this species.

No answer has been evolved thus far as to approximating the maximum probability of finding a given species. It may reside in knowing the preferred habitat for the species, then sampling as near to it as possible. The range

of tolerance should be known, too. That some organisms exhibit a wide range is shown by the studies of Lytle Creek and the Santa Fe River. Lytle Creek is a hard-water stream, well fertilized, in a temperate zone. The Santa Fe is a larger, soft-water stream, with little fertilization and probably much tannic and humic acid, located in a subtropical environment. Yet these streams had 99 species in common. In addition, many of the species occurring in only one of these streams have been found in habitats near the other stream. More complete analyses, or perhaps more numerous ones, would probably reduce still further the species found in only one or the other area. The question, then, is what peculiar conditions give rise to an abundance of a given species.

Such considerations as these emphasize the importance to the ecologist of careful chemical and physical studies of a habitat. Perhaps we may yet be able to say with certainty that, since an environment presents certain characteristics, we can expect to find certain species there.

### Summary and Conclusions

In comparative studies of three streams in the United States, quantitative and qualitative determinations of the suspended algae and protozoa provided specific evidence of the fertilizing effects of a treated sewage effluent on some species of these organisms.

In Lytle Creek, a small stream in southwestern Ohio which receives effluent from a primary sewage treatment plant, a total of 167 species were found. Certain species of Euglenophyceae were exceptionally abundant at points below the plant outfall. Chlorophyceae and Chrysophyceae were adversely affected by the effluent.

Of 92 species of microbiota in Cowan Creek, a similar but unfertilized stream in the same area, only Chrysophyceae and diatoms (Bacillarieae) were abundant.

In the Santa Fe River, a larger unfertilized stream in Florida, 332 species were found, but none of them occurred in large numbers.

Species common to both the Ohio and Florida waters totaled 99, indicating a wide environmental tolerance for these species.

The more intensively a given environment is

sampled, the greater is the possibility of finding a given species therein, provided the environment falls within its range of tolerance. The environmental ranges of many microorganisms are wide enough for the organisms to be termed ubiquitous. But such organisms may reproduce rapidly enough to form blooms only within a narrow range the critical factor, or combination of factors, of which rarely occurs. Recent fecal pollution appears to be one such factor for certain species of Euglenophyceae. The same environment appears to be limiting for some species of Chrysophyceae.

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*A list of the micro-organisms found in the Santa Fe River may be obtained from the author.*

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## Air Pollution Research

Five Federal agencies have been awarded contracts for community air pollution research in the Public Health Service air pollution program, for use during fiscal year 1956.

The Weather Bureau, Department of Commerce, allocated \$196,000, is studying the dilution and dispersal of contaminants in the atmosphere. The assignment includes devising ways of surveying problem areas, evaluating existing weather data to determine air pollution potentialities, and predicting weather conditions that may intensify air pollution.

The National Bureau of Standards, Department of Commerce, has been allocated \$98,000 for developing methods of analyzing and identifying various gaseous contaminants of the atmosphere. This bureau is exploring ways of collecting and treating condensable pollutants and of analyzing concentrated samples of the atmosphere. It is also studying reactions among gases and other chemicals in the air.

The Bureau of Mines, Department of the Interior, also allocated \$98,000, is investigating causes of inadequate incineration of combustible wastes and means of improving incineration. It will study sulfur dioxide removal processes and evaluate elements from internal combustion in engines which may contribute to air pollution. It will also sample a limited selection of stack effluents.

Additional agreements with other Federal agencies include one with the Library of Congress for the preparation of a continuing annotated air pollution bibliography and one with the Department of Agriculture for the assignment of a plant physiologist to the program. The physiologist will initiate investigation of the use of plants as air pollution indicators and assist in coordinating the air pollution activities of the Service and the Department of Agriculture.

Contracts for research to be conducted by non-Federal agencies were consummated with the following: Baylor University for a preliminary study to determine the feasibility of using tissue enzymes to evaluate the toxicity of air pollutants (\$34,000); the University of Nebraska for a study to determine the feasibility of using tissue culture to evaluate the toxicity of air pollutants (\$31,000); the State College of Washington for the development of an automatic air pollution sampling and recording instrument (\$17,590); and the Franklin Institute for a study of the feasibility of collecting and storing air samples by compressing atmospheric air and storing it in suitable containers for subsequent chemical or physical analysis of vapor-phase contaminants (\$16,064). Other contracts for research are being negotiated.

# Diagnosis of Psittacosis in Parakeets

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THE RECENT remarkable increase in the popularity of parakeets (budgerigars) as household pets poses a question of whether this trend has been accompanied by a rise in the incidence of psittacosis. With increasing awareness of this disease, there has undoubtedly been a tendency to diagnose and report cases which in other times might not have been identified. Nevertheless, there appears to have been a real rise in the attack rate of psittacosis (1, 2). This emphasizes the need for a rapid and simple diagnostic test for psittacosis that can be used by local laboratories.

The clinical resemblance of psittacosis to other forms of pneumonitis and influenza-like illnesses makes confirmation of the diagnosis by laboratory methods almost mandatory. Early antibiotic therapy, so often employed today, makes impossible the diagnosis of psittacosis by

isolation of the virus from suspected human cases. Such therapy may also suppress or delay antibody development, leaving the physician without any direct laboratory support for his clinical diagnosis. Quite often the pet parakeet or other psittacine contact may be the only supportive evidence for such diagnosis.

Psittacosis virus may cause an apparent or inapparent infection in birds, but even in the overt disease the symptoms are not pathognomonic. Moreover, apparently healthy birds frequently shed psittacosis virus. Physical examination of the bird is insufficient for a correct diagnosis in sick birds and entirely inadequate for the detection of silent infections. The isolation of the virus from infected birds offers the most accurate diagnostic method, but it entails sacrificing of the birds to obtain tissues, a procedure often objected to by an owner for sentimental reasons and by breeders or dealers for economic reasons. Therefore, a less expensive test was sought, one which would reliably detect infection in live birds.

Serologic tests, particularly complement fixation tests, have proved to be of diagnostic value with human serums (3). The complement fixation test has also been found to be useful in tests with pigeon and parrot serums (4, 5). The serums of domestic fowl, while not reacting in the usual complement fixation test, will yield definitive results when tested by the indirect complement fixation test (6, 7). The serums of sea birds infected with psittacosis virus also have been shown to react in the direct complement fixation test (8).

It appeared desirable, therefore, to compare

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the results of the complement fixation test on serums of parakeets bled during life with results of virus isolation attempts from their droppings and from their tissues when they were subsequently sacrificed and to investigate the possibilities of practical application of serologic techniques for the detection of infected flocks.

## Materials and Methods

The parakeets in this preliminary study were obtained from 19 different owners of small "backyard" aviaries in the vicinity of Albany, Ga., except for one flock which was selected from a larger group confiscated by the State of New Jersey.

### *Bleeding of Parakeets*

Serum was obtained from the parakeets by bleeding from the jugular vein, using a 25-gauge,  $\frac{1}{2}$ -inch hypodermic needle attached to a 1.0-ml. tuberculin syringe which was previously wetted with physiological saline solution. The parakeets were anesthetized with ether before bleeding. One ml. of blood was withdrawn and the serum separated from the clot by centrifugation. The birds withstood the removal of 1.0 ml. of blood quite well. In fact only one bird of this series died following the bleeding, and this death was apparently caused by excessive anesthesia.

### *Antigen*

Two psittacosis antigens were used. The first antigen was prepared from allantoic fluids of chick embryos infected with psittacosis virus recently isolated from a parakeet. The embryos were inoculated intra-allantoically with  $10^{-1}$  or  $10^{-2}$  dilutions of virus on the eighth day of incubation and the fluids were harvested 5 to 6 days later. These were centrifuged at 1,000 r.p.m. for 10 minutes and heated at  $100^{\circ}$  C. for 20 minutes or treated with phenol in 0.5 percent concentration. The second antigen consisted of heated and phenolized yolk sac material from infected chick embryos.

### *Complement Fixation Test*

The procedure for the complement fixation test was as follows:

Serial fourfold dilutions of heated inactivated serums were made in veronal buffered saline. The first dilution varied from 1:2 to 1:8, depending upon the quantity of serum available. The serum dilutions were distributed in 0.1-ml. volumes to 3 rows of tubes. The first row was the test row and received 0.1 ml. of psittacosis antigen in optimal dilution. The second row served as a control for nonspecific reactions and received 0.1 ml. of normal allantoic fluid in the same dilution. The third row measured anticomplementary activity of the serum; it was given 0.1 ml. of veronal buffered saline.

To each tube was added 0.2 ml. of complement diluted to contain 1.5 to 2 units. The tubes were placed in the refrigerator overnight. Following this, 0.2 ml. of sensitized sheep cells (consisting of equal volumes of 2 percent cells and optimally diluted hemolysin) were added and the tubes incubated at  $37^{\circ}$  C. for 30 minutes. The titers represent serum dilutions which gave 3+ or 4+ readings followed by readings of "zero." When a 4+ was followed by a 1+ or 2+ reading, the titer was interpolated as being midpoint between the two dilutions. For example, if 1:16 dilution gave a reading of 4+, and 1:64 read 2+, the titer was considered to be at 1:32.

Each test was accompanied by the usual positive, negative, hemolytic system and cell controls. Unpublished results obtained in this laboratory indicate that human serums can be tested successfully with either psittacosis or lymphogranuloma venereum (LGV) antigens, but parakeet serums tended to react more specifically with psittacosis antigen in the complement fixation test. The psittacosis antigen may be preferable, therefore, for the testing of bird serums.

The indirect complement fixation test was performed by incubating at  $37^{\circ}$  C. for 1 hour 0.1 ml. each of the test serum, complement (2 units), and antigen (2 units). After this 0.1 ml. of a psittacosis immune mammalian serum (2 units) was added and the mixture again incubated for 1 hour at  $37^{\circ}$  C. Finally 0.1 ml. of 4 percent sensitized sheep cells was added and readings were made after 45 minutes incubation at  $37^{\circ}$  C.

Each test was accompanied by a direct fixa-

tion control in which a negative mammalian serum was substituted for the mammalian psittacosis positive serum. The usual controls for nonspecific, anticomplementary, and hemolytic reactions were also included for each test serum. Any serum which inhibited the fixation of complement by the known positive serum as indicated by readings of "zero," 1+, or 2+ was considered positive even if this reaction was observed only in the most concentrated dilution.

### *Virus Isolation*

For virus isolations from excreta, the droppings from individually caged birds were suspended in a solution of 10-percent horse serum in buffered water, the proportions being approximately 1:3 by volume. After centrifugation at 300 times gravity for 10 minutes, the supernate was removed. Streptomycin sulfate was added in concentrations of 2.0 mg. per ml. of supernate, and the mixture was inoculated in volumes of 0.3 ml. intraperitoneally into groups of 3 to 5 mice which were 3 to 4 weeks old. Psittacosis virus was considered isolated when the mice developed ascites or died, with typical elementary bodies being demonstrated in smears from the peritoneal serosa.

When testing for virus in the tissues, an approximate 20 percent suspension of the liver and spleen of each bird was prepared and inoculated intracerebrally in volumes of 0.03 ml. into groups of 5 mice. Demonstration of elementary bodies in the smears from the meninges following a typical course of symptoms and death was the criterion of virus isolation.

### **Results**

The results observed from testing 130 para-keets for both the presence of specific direct complement-fixing antibody in their serum and for virus in their tissues are shown in table 1. There was agreement between the two tests in 85 of 125 birds (5 were unsatisfactory in the complement fixation test). Of 30 birds from which virus was isolated, the serum of 5 failed to give a reaction in the complement fixation test. It is possible that serums from these birds were taken early in the infection prior to the development of demonstrable antibodies. The serum of

**Table 1. Psittacosis virus isolations from serologically positive and negative para-keets**

Results	Serums reacting to—	
	Direct CF test	Indirect CF test
Negative serologically; no isolation	61	26
Positive serologically, isolation	24	23
Positive serologically, no isolation	35	35
Negative serologically; isolation	5	3
Total	125	87

a sixth bird was anticomplementary. No virus was isolated from 35 of the 59 birds whose serums gave a positive complement fixation reaction. This could mean that the virus isolation test was not sensitive enough to detect the amounts of virus present at the time, or that these birds had actually recovered from psittacosis infection and were free of virus but still possessed circulating antibody.

Birds from 13 flocks failed to yield virus when their livers and spleens were tested (table 2). Fifty-five of the fifty-eight birds so represented also failed to show complement-fixing antibody in their serums. Both tests yielded

**Table 2. Comparison of virus isolations made from flocks with and without antibodies to psittacosis**

Flock No	Number para-keets tested	Number CF positive	Number virus isolations
1	24	21	15
2	5	2	2
3	3	1	0
4	8	1	0
5	5	2	1
6	4	4	3
7	4	1	0
8	5	2	4
9	25	25	4
10	5	0	0
11	11	0	0
12	3	0	0
13	3	0	0
14	4	0	0
15	3	0	0
16	4	0	0
17	1	0	0
18	3	0	0
19	6	0	0

positive results in 6 aviaries. The degree of correlation varied from 15 virus isolations versus 21 positive complement fixation tests (aviary 1) to 4 isolations versus 25 positive complement fixation tests (aviary 9). These findings may signify differences in the duration of infection in these 2 aviaries.

From flocks known to be infected, 74 parakeets were selected for a comparison of results of virus isolation from the droppings taken during life and from the liver and spleen at autopsy when sacrificed. Several samples of droppings were tested from some of these birds; only single samples were tested from others. Serum specimens were taken from all of the

birds for parallel serologic studies. The results are shown in table 3.

Of the 23 parakeets in which tissues yielded psittacosis virus, only 13 shed virus in their droppings. The age or sex of the bird did not appear related to the excretion of virus. Virus was isolated from the droppings of one young female parakeet although no virus was obtained from its liver and spleen upon autopsy. In most cases repeated samples of droppings were taken at weekly intervals. Only 2 of the 10 birds which gave evidence of virus in any of three fecal specimens were excreting detectable amounts in all three samples.

The five birds with serums that gave positive

Table 3. Correlation of the presence of psittacosis virus in tissues and droppings and complement fixation antibody titers in individual parakeets

Parakeet No.	Age	Sex	Virus in tissue	Virus in droppings			CF antibody titer	Parakeet No.	Age	Sex	Virus in tissue	Virus in droppings			CF antibody titer
				1	2	3						1	2	3	
1	y	f	-	-	-	-	<1:8	38	y	nd	-	-	-	-	<1:2
2	y	f	-	-	-	-	<1:8	39	y	nd	+	+	-	-	<1:8
3	y	f	-	-	-	-	<1:8	40	A	f	+	-	-	-	<1:2
4	y	f	-	-	-	-	<1:8	41	A	f	-	-	-	-	1:32-1:64
5	y	m	-	-	-	-	<1:8	42	y	f	-	-	-	-	<1:8
6	y	nd	-	-	-	-	1:32	43	A	f	-	-	-	-	<1:4
7	y	nd	+	-	-	+	1:32	44	A	f	-	-	-	-	<1:8
8	A	nd	+	-	-	-	1:8	45	A	f	-	-	-	-	<1:4
9	y	nd	+	-	-	-	1:8-1:16	46	A	m	-	-	-	-	<1:4
10	y	nd	+	-	-	-	<1:8	47	y	m	-	-	-	-	<1:4
11	y	nd	+	-	-	-	1:8	48	A	f	+	+	-	-	<1:4
12	y	nd	+	-	-	-	1:8-1:16	49	A	f	+	+	-	-	<1:4
13	y	nd	+	-	+	+	1:128	50	A	f	+	-	-	-	1:16
14	A	m	+	-	+	+	1:128	51	y	f	+	-	-	-	1:2
15	y	m	+	+	+	+	1:128	52	y	m	+	-	-	-	<1:4
16	nd	nd	+	+	+	+	1:32	53	A	f	+	-	-	-	1:20
17	A	nd	+	-	-	+	1:8	54	A	f	-	-	-	-	1:40
18	y	f	+	+	-	-	AC	55	A	f	-	-	-	-	1:16
19	A	m	+	-	+	+	1:128	56	A	f	+	-	-	-	1:32
20	y	f	+	+	+	+	1:8	57	y	m	-	-	-	-	1:40
21	y	f	+	+	-	-	1:8	58	y	m	-	-	-	-	1:8
22	nd	nd	+	-	-	-	1:32-1:64	59	y	m	-	-	-	-	1:40
23	A	m	-	-	-	-	<1:8	60	y	m	-	-	-	-	1:4
24	A	f	-	-	-	-	1:8	61	y	m	-	-	-	-	1:8
25	A	f	-	-	-	-	1:8	62	A	f	-	-	-	-	1:8
26	A	m	+	+	-	-	1:128	63	A	f	-	-	-	-	1:64
27	A	f	-	-	-	-	1:32	64	A	m	-	-	-	-	1:5
28	nd	nd	-	-	-	-	1:4	65	A	m	-	-	-	-	1:5±
29	nd	nd	-	-	-	-	1:8	66	A	m	-	-	-	-	1:64
30	y	f	+	+	+	-	<1:8	67	A	f	-	-	-	-	1:16
31	nd	nd	-	-	-	-	<1:8	68	A	f	-	-	-	-	1:16
32	A	m	-	-	-	-	<1:2	69	A	m	-	-	-	-	1:40
33	y	f	-	-	-	-	<1:2	70	A	m	-	-	-	-	1:40
34	y	f	-	-	-	-	<1:2	71	A	f	-	-	-	-	1:5
35	y	nd	-	-	-	-	<1:2	72	A	f	-	-	-	-	1:64
36	y	nd	-	-	-	-	<1:8	73	A	f	-	-	-	-	1:5
37	y	nd	-	-	-	-	<1:2	74	A	m	-	-	-	-	

y=young; A=adult; nd=not determined; - =virus not isolated; + =virus isolated; f=female; m=male; AC=anticomplementary.  
 1 Or greater.



complement fixation reactions at dilutions of 1:128 or greater were all shedding virus in their droppings. However, several which shed virus had CF titers of only 1:8, and three birds yielding virus from both droppings and tissues had no demonstrable CF antibodies. Possibly, the latter two groups of birds were in early stages of infection. Further studies on the pathogenesis and immunology of the disease in birds are necessary for proper interpretation and correlation of these data.

Of one flock of 49 birds examined by the complement fixation test, the serums of 25 reacted with psittacosis antigen. Ten of the reactors were removed and isolated from the flock 12 days later, and attempts were made to isolate virus from their droppings. Virus was recovered from only 2 of the 10. The remaining 15 reactors were then isolated from the flock 49 days after the original testing, and again virus was isolated from the droppings of 2 of these birds.

Fifty-five days after the first bleeding, second serum specimens were collected from the 24 birds which previously had shown no antibody. By this time all but one bird gave positive CF reactions with psittacosis antigen. Between the time of the first and second bleeding, breeding activities were initiated in this flock. This circumstance, plus the delayed removal of infected birds, may have been responsible for the apparent spread of infection within this flock.

A large group of young parakeets obtained from a wholesale dealer in New Jersey became available for study. Fifty of these birds were killed and their tissues tested for the presence of virus. Five of these yielded psittacosis virus. However, no antibody could be demonstrated in 197 serums by repeated direct complement fixation tests in which all controls indicated a satisfactory test.

These serums were then examined by the indirect complement fixation test. The type of correlation to be expected within an infected flock became apparent with the results obtained by this indirect test. Of 87 parakeets tested by both serologic and virus isolation techniques, 26 were negative by both tests, 23 were positive by both tests, 35 were serologically positive but failed to yield virus, while 3 were serologically

negative yet virus was isolated from their tissues (table 1).

### Summary and Conclusions

In the parakeets studied in this series, a close correlation was demonstrated between the results of complement fixation tests for psittacosis antibody and of virus isolation from tissues. Psittacosis virus was isolated from 47 of the 117 birds showing either direct or indirect complement fixation antibody titers of 1:2 or greater. Virus was not isolated from 87 of 95 parakeets whose serums contained no demonstrable antibodies. Most of the birds with antibody from which virus could not be isolated were obtained from known infected flocks. Conversely, only the serums of 3 of 55 birds obtained from flocks considered to be free of psittacosis virus (on the basis of a 10 percent sampling) reacted positively to the complement fixation test and then only in a low titer. A larger sample might have indicated that virus was present in the two flocks from which these birds came.

The significance of a positive titer in relation to the infectiousness of an individual bird remains to be determined, but the finding of at least some birds with antibodies may be regarded as evidence of past or present infection in that flock. Such a flock should be suspected and the birds with negative serums should be retested in 3 to 6 weeks. The presence of additional birds with antibodies at this time would provide presumptive evidence that active infections were present in the aviary. Continued absence of antibodies in a flock may be considered an indication of absence of current active infection.

The reason why some birds develop antibodies that can be detected in the direct complement fixation test while others develop only indirect complement-fixing antibodies is not understood. However, the results indicate that parakeet serums should be subjected to both tests before being considered negative.

Although isolation of virus will remain the most conclusive method for the diagnosis of psittacosis in individual birds, this expensive and time-consuming procedure need not be applied for the detection of infection in flocks.

Where facilities for virus isolation do not exist, or the number of birds to be tested is excessive, the complement fixation test should prove to be especially valuable. Aside from being one of the more reliable of the complement fixation tests for virus, it is relatively rapid and simple. This test should be added to the diagnostic armamentarium of every local public health laboratory.

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## Increase in Juvenile Delinquency

The Children's Bureau, Department of Health, Education, and Welfare, has been receiving an increasing number of requests for help from States and communities who are trying to plan services for delinquent children more effectively.

The Bureau reported on May 20 that about a half million children were brought to juvenile courts for delinquency in 1955 and that juvenile delinquency continued to increase during that year. The Bureau, which annually receives reports from a number of juvenile courts on the juvenile delinquency cases they handle, has prepared preliminary estimates of the rates of increase.

Some 977 courts reporting to the Bureau in both 1954 and 1955 experienced a 9-percent increase in juvenile delinquency cases over that period. Likewise, a trend group of 383 courts which have been reporting for many years also show a 9-percent increase in the 1954-55 period. While the increases in cases

were occurring, the child population in the 10-17 age group went up only about 3 percent. Generally, this is the age group within the jurisdiction of the juvenile court.

Not all children brought to attention of the police have committed offenses serious enough to warrant court action. The 9-percent increases in juvenile court cases may understate the actual increase in the number of juvenile delinquents in 1955. For example, the latest Federal Bureau of Investigation uniform crime report shows an 11.4 percent increase in police arrests of young persons under 18 in 1955 as compared with 1954. The FBI report is based on data from 1,162 cities.

Hopefully, joint efforts of local, State, and Federal groups can pull the delinquency rate down. Toward that end, consultants in the Bureau's Juvenile Delinquency Service Division are working with local communities and States in planning prevention and treatment programs.

# *Surgical Experience in Selected Areas of the United States*

The era of modern surgery began only about 1875, although more than 20 centuries ago some surgical operations were performed, with much pain and suffering for the patient and an exceedingly high case fatality. Nearly all of the major developments that have made surgery safe and widely used have come since about the middle of the 19th century.

The use of surgery and related procedures in the armed forces has increased considerably in the past 50 years. However, the numbers of certain of the most frequent operations, such as tonsillectomy and appendectomy, have declined in the past 10 years.

Surveys of some years ago indicated that tonsils had been removed in roughly 40 percent of 15-year-old children and appendixes had been removed in 10 percent of 24-year-old persons.

Illness surveys of households in selected areas in the United States indicate that tonsillectomy is the most frequent surgical operation among persons of all ages combined, with surgery for accidents and appendectomy second and third. However, benign tumors except of the female genital organs had the largest percentage of cases treated surgically, with appendicitis second and congenital malformations third. In terms of five broad age groups, tonsillectomy is first in frequency in the two age groups under 15 years, second in the three age groups 15-64 years, but is ninth at 65 and over. Appendectomy is tenth in frequency under 5 years of age, third in the three age groups 5-44 years, fifth at 45-64, and is not found among the 10 most frequent operations at 65 and over. Accidents, except poisoning, were the first cause of surgery in the four age groups above 15 years, and the second cause in the two age groups under 15.

It is generally but not invariably true that

relative variation with age is greater in surgical rates per 1,000 population than in percentage of cases treated surgically.



Public Health

MONOGRAPH

No. 38

The accompanying summary covers the principal findings presented in Public Health Monograph No. 38, published concurrently with this issue of Public Health Reports. The authors are with the Division of Public Health Methods, Public Health Service.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

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Collins, Selwyn D., Lehmann, Josephine L., and Trontham, Katharine S.: Surgical experience in selected areas of the United States. Data on surgical operations from periodic canvasses of households, supplemented by United States Navy reports and nationwide hospital surveys. Public Health Monograph No. 38 (Public Health Service Publication No. 473). 48 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956. Price 35 cents.

Among the surgical operations with rather definitely higher rates for males are those for accidents except poisoning, hernia, hemorrhoids, and ulcer of the stomach and duodenum. Among operations with definitely higher rates for women are those for cholecystitis and biliary calculus, thyroid diseases, malignant neoplasms, diseases of the bones, joints, and other organs of locomotion, and appendicitis in the young adult ages.

Major surgery was considerably more frequent among females than among males, with a peak at 30 years and with lower rates at younger and older ages. Among males, major surgery increased rather consistently with age,

with the highest rate in the oldest age group. The peak of all minor operations comes at 5-9 years of age, with only a moderately lower rate for children under 5 years.

The American Hospital Association's published report on a survey of 1949 includes an estimate of more than 9 million operations in all hospitals in the United States. However, the proportion of operations performed in long-term hospitals, such as those for mental diseases and tuberculosis, is relatively small. Estimates for short-term hospitals only, based on the association's report, indicate some 7,200,000 operations or a rate of 49 operations in short-term hospitals per 1,000 population of the United States.

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## technical publications

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### Protecting Children in Adoption. Report of a Conference

*Children's Bureau Publication No. 35½. 1955. 20 cents.*

Of the threefold interests in every adoption—the child, his natural parents, and his adoptive parents—that of the child is paramount. This was the major conclusion arrived at in a conference of 31 national organizations of the medical, legal, and social professions considering the protection of children in adoption. Any discussion of adoption leads back to the unmarried mother, and medical, legal, and social services for the unmarried mother are the first line of defense.

Some of the points brought out were:

Placement of the child in an adoptive home involves team work of doctors, lawyers, and social workers and for this reason, placements are best made in a community-sponsored setting, by an agency authorized for the purpose.

Unmarried pregnant girls are getting less medical care and later in pregnancy than married women.

Some of the most vicious "black market" cases involve girls frightened or coerced into signing a relinquishment for their babies before or immediately after delivery, in order to get medical and hospital care.

Many doctors are unaware of existing social agencies in their communities, particularly those designed to help unmarried mothers.

### New Hope for the Disabled

*Office of Vocational Rehabilitation Publication VR-ISC-13. 1956. 23 pages; illustrations. 15 cents.*

The major provisions of the Vocational Rehabilitation Amendments of 1954 (Public Law 565) are outlined and explained in this booklet. It lists the services available to the handicapped under the new law, summarizes the three-part Federal grant-in-aid structure established by

that law, and delineates the role of the Office of Vocational Rehabilitation in the State-Federal rehabilitation program.

The amendments to the Randolph-Sheppard Act (1954) and such related legislation as the Medical Facilities Survey and Construction Act of 1954 and the Social Security "disability freeze" amendments of the same year are discussed.

Listed are the names and addresses of regional representatives of the Office of Vocational Rehabilitation and locations of the main offices of the State vocational rehabilitation agencies from whom further information may be obtained.

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This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

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*Feminine-maternal traits, emotional stability, tolerance, and mature response to aggression or infantile conduct are among the assets to look for in nurses assigned to the care of excessive eaters and drinkers. Psychological studies offer guidelines for identifying suitable personality traits in candidates for nursing nutritional deviants.*

## Nurses for Alcoholics

By GIORGIO LOLLI, M.D.

THE number of hospital wards, sanatoriums, nursing homes, and clinics devoted to the care of alcoholics is growing steadily with the realization of the contemporary magnitude of this problem and the improved methods of diagnosis and treatment. At the same time the importance in our culture of other deviations in nutritional habits, such as obesity and leanness, is gaining increasing medical attention.

The establishment of facilities for the treatment of deviations in eating or drinking has naturally created a demand for qualified professional personnel. The personality traits of nurses to be assigned to services of this type are of particular consequence.

The serious responsibilities attendant upon ministering to the sick call for painstaking care in the selection and assignment of all nursing personnel. Hospital executives in the past had to rely, and not without considerable success, on their empirical experience and intuition for guidance in this function. The trend now, however, is toward application of sound and proved psychodynamic principles to the appraisal of nurse candidates. But still more can be achieved if selection is geared to the needs of treatment teams working with special classes of patients.

My discussion, therefore, centers on the importance of the emotional makeup of nurses to be assigned to a service devoted to the correction of deviant eating and drinking habits in which the approach is simultaneously medical, psychological, and social.

The extension of these principles to other types of clinical services, it is hoped, will be self-evident.

The emphasis on interactions between the nurse and the alcoholic patient should be construed only as an expression of the belief that the nurse who is able to deal adequately with the alcoholic can also deal appropriately with all patients regardless of the condition for which they need nursing care. When sick, all individuals to a certain extent revert to infantile patterns of behavior. The understanding and handling of this behavior is facilitated by knowledge about alcoholism—a condition which results from the eruption of infantile traits in adult age.

Finally, it is assumed that the importance of the nurse's professional qualifications is universally granted and needs no further emphasis here.

The suggested criteria represent an ideal conception of the nurse qualified to work in a service for eating and drinking deviants. But even if ideals seldom, if ever, can be attained in full, our constant goal should be to approach the model.

A systematic evaluation of the emotional as-

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sets and liabilities of the nurse prior to her assignment to a particular service will weed out some candidates who would affect and be affected unfavorably by the institutional group. Of course, evaluation must continue after the nurse becomes a member of the staff. It should be an endless and creative process of mutual criticism wherein the appraisal of the newcomer by the older members is not more important than her appraisal of the group. Final decisions about long-term employability should be taken only after several months of trial.

Certainly nurses, like other members of the human race, cannot be expected to be without emotional inadequacies. However, some difficulties which are not necessarily handicaps in other professions or occupations might present a serious threat to a satisfactory nurse-patient relationship.

The emotional problems which represent a handicap in a nurse assigned to a service for deviant eating and drinking habits usually are deeply rooted and difficult to alleviate or solve. The illusion that personality changes may occur as a result of learning experiences with staff members or with patients should not be fostered. In a service of this type, time is seldom available for entirely adequate treatment of the patient. Time is never available for more than a superficial approach to the emotional difficulties of members of the staff. On the other hand, emotional problems of the staff may be swiftly magnified, or change from latency into open manifestations, as a result of exposure to an emotionally disturbing environment.

In the selection and evaluation of nurses, the concept of "compatible neuroses" is a practical one. When a new nurse is employed the composition of the staff as a whole should be kept in mind. It is desirable to visualize what effects the new member of the team will have on the older ones. For instance, some obvious handicaps in a nurse supervisor can be tolerated if other members of the team do not exhibit similar traits or are not too sensitive about them.

Excessive drinking, excessive eating, and deviant nutritional habits in general are linked with the very dawn of emotional life. Through the first nutritional experiences the first social experiences of the adult-to-be take place. Adequate hunger-linked emotions are those of love,

warmth, and mutual tenderness. The inadequate ones are those of hate, violence, and resentments in general. A mutually rewarding mother-child relation favors the development of adequate hunger-linked emotions. Conversely, an unsatisfactory mother-child relation has untoward repercussions unless outweighed by later and more favorable experiences.

When psychological and social techniques are applied to problems of nutrition and nutritional habits, uncontrollable emotions often flare up quickly and violently not only in patients but also in emotionally ill-equipped therapists. The reason for this is that the emotions linked with deviant nutritional habits are antisocial in their nature. Indeed, it may be that unconscious fears related to these emotions account for the paucity of attention given thus far to the psychological and social aspects of hunger and of nutritional habits in general.

### Physical Characteristics

In a general hospital, the nursing staff of a service for nutritional deviants should be limited to women. A general hospital has male attendants available if necessary for security. Experience has shown that with properly trained and emotionally fit women nurses, with medication administered promptly and adequately, and with a response to violence which emphasizes firm and fearless tolerance, the need for restraints and for the use of force in general is practically nil.

The limitation to women nurses is based on the crucial role played by women in bringing up children, as known from time immemorial and confirmed by scientific research during recent decades. While unsatisfactory mother-child relations contribute to all cases of adult maladjustment, they are especially decisive in those directly linked to deviant nutritional habits. Conversely, healthy emotional experiences with adequate women may help to alleviate or wipe out the painful pressure of half-buried experiences with the woman who is of paramount importance in the life of every human being. This stress on the significance of an unhealthy mother-child relationship should not be construed as "criticism" of the mothers of

patients or of the patients themselves. It is simply a recognition of the fact that inadequacies of the mother-child team have far-reaching consequences.

The marital status of the nurse seems unimportant. There are countless single women who display clear-cut feminine personality characteristics, objective attitudes toward sexual behavior and its deviations, and ability to participate in a variety of mutually rewarding social relations. Because healthy attitudes toward sex problems are often entirely unrelated to sex experience in real life, inquiries about sex life are seldom important for evaluation. Such inquiries may rather be symptomatic of the problems of the interviewer than evocative of those of the candidate.

It follows that marriage or sex experience does not make feminine a woman who is not so from the start; nor will either or both solve sexual problems. The presence or absence of sexual difficulties stems psychodynamically from the presence or absence of maladjustment in the area of hunger-linked emotions. This is why problems connected with distortions of the ability to love, to relate to people, to be tender, to express warm feelings appear to be of fundamental significance.

The age of the candidate is of secondary importance, provided she is in excellent physical health.

### Shared Handicaps

In a service devoted to deviant eating and drinking habits, excessive drinking and marked overweight or underweight represent obvious handicaps. Moderate overweight or underweight can be tolerated if the nurse is able to accept possible criticism from patients about her "weakness" and to use the handicap as a veiled indication that she is "not different." One of the main difficulties of the neurotic patient is his feeling that he is "different." He sometimes feels encouraged by seeing that other people who have achieved some measure of success in life also exhibit handicaps similar to his own.

If her language is clearly intelligible, a foreign accent should not disqualify a candidate. In many cases, the neurotic patient feels him-

self a "stranger" or "estranged." Contact with another "stranger" may be emotionally helpful. People sometimes share with a traveling companion, a stranger, facts and feelings which they could not share with a close friend.

The ability to express herself clearly in writing, however, is important for the nurse because of the great value of her observations, which should be recorded in detail.

With these possible exceptions, however, it must be remembered that in a professional nurse-patient relationship the emphasis should be on shared assets rather than on shared handicaps.

All that has been said thus far in no way attenuates the importance of basic professional and technical training. In addition, some knowledge or at least some specific interest in nutrition and dietetics is desirable since the attitude of the deviant patient toward food often supplies revealing clues to his emotional life.

### Psychodynamic Principles

It is advisable that a candidate be interviewed separately by two members of the staff whose training and experience allow them to base an evaluation of the nurse's assets and liabilities on sound psychodynamic principles.

The following questions may be considered as a general guide for interviewers but are not intended to be used as an interview outline.

*Has the candidate ever had any problem connected with the excessive use of alcohol or drugs?* If so, a thorough psychiatric evaluation should be conducted before a decision is taken, even if the addiction to alcohol or drugs is no longer active. The rule that persons presently addicted to alcohol or drugs should not be considered for a position in a service specializing in eating and drinking deviations has no exceptions. For persons who were addicted to alcohol or drugs in the past, this rule could have some exceptions which only a thorough personality study of the candidate may justify.

The emotions linked with excessive use of alcohol or of drugs and those linked with nutritional deviations in general tend to be explosive. These are the emotions whose distortions lead to a variety of serious individual and social disorders, besides alcoholism or drug addiction.

Persons suffering from these emotional turmoils often have their problems fanned by exposure to patients suffering from similarly distorted emotional constellations.

The experience of Alcoholics Anonymous, an association of former excessive drinkers who help each other to keep sober, might seem to contradict this viewpoint. A deeper examination of the difference between a therapeutic relationship with patients and fellowship in Alcoholics Anonymous will prove that no such contradiction exists.

The attitude toward Alcoholics Anonymous of any service dealing with alcoholic patients should be friendly and cooperative, giving full recognition to the great contribution of this movement to the alleviation of the problem of alcoholism.

In most cases the professional therapeutic approach to the alcoholic patient is compatible with the activities of Alcoholics Anonymous. Thus, with exceptions based on psychiatric contraindications, the alcoholic patient should be encouraged to participate in the movement. Nevertheless, the fundamental differences between a professional and a nonprofessional approach must never be lost to sight. It is true that all professional as well as lay methods used to control alcoholism are based on the same process: Emotional energies tied to physical disability, psychological inadequacies, and social maladjustment, or a combination of these disorders, are liberated through the alleviation or correction of the handicaps and then used to keep the urge to drink in check. But professional approaches and the Alcoholics Anonymous method differ quite markedly in the degrees of alleviation and correction of the medico-psycho-social handicaps and even more in the techniques of achieving such alleviation or correction.

The members of a professionally trained treatment team should approach the alcoholic, as all patients, on the fertile ground of common humanity. The lines of communication with him are tacitly sustained by the assets shared with him. While the therapists take their own liabilities for granted, they do not share them with the alcoholic beyond the implicit admission of their existence.

To try to cooperate with the alcoholic on a

professional level calls for a variety of assets in the nurse. She must be able to direct an abundant, flexible, and timely flow of emotions to those areas of her personality which are challenged by the alcoholic's difficulties. For example, there is need for large emotional reserves so that the response to aggression will be tolerance, so that the wounds inflicted by hate will be healed without excessive challenge to the nurse's proper attitude. In the ideal attitude, the nurse's wishes and her ethical duties should coincide.

Emotional reserves are not ample in the alcoholic. The nurse addict is no exception even if her abstention from alcoholic beverages has been of reasonably long duration, because she needs these emotions to keep in check her own addictive urge. This situation makes it difficult for her to deal with alcoholics on a professional basis.

The alcoholic nurse, like any other addict, is able to deal with and help her fellow alcoholics on a nonprofessional basis. This is shown decisively by repeated experience in Alcoholics Anonymous, where the line of therapeutic communication between members is sustained by the shared conscious experience of a handicap (namely, addictive drinking) and by the shared unconscious experience of those guilt-laden emotions which lead to addiction. The fact is that less emotional energy is required by the alcoholic to abstain in Alcoholics Anonymous than to refrain from drinking in response to professional treatment. The more economical achievements of Alcoholics Anonymous result from the circumstance that within the framework of the movement the addictive urge to drink is kept in check by mutually potentiating group emotions whose pressure is concentrated intensely—sometimes violently—on the interplay of the two opposites: inebriety and sobriety.

A sound and adequate professional approach, on the other hand, leads to an ampler expansion and to a greater flexibility of the alcoholic's personality. The outcome is deeper: a less rigid acceptance of life in general and a more secure attitude toward the lifelong liability connected with the alcoholic problem in particular.

As already noted, professional and Alcoholics Anonymous approaches are compatible and



their combination is advisable in many cases of alcoholism. In combined approaches, the abstinence from alcohol achieved and maintained in Alcoholics Anonymous does not drain the alcoholic's emotions drastically and enables him to face a professional approach with greater chances of personal improvement.

But this fact must be borne in mind: While the alcoholic can "receive" profitably a combination of professional and nonprofessional help, only exceptional persons can give professional and nonprofessional help to the alcoholic at the same time. Yet this is the dangerous situation faced by a professional nurse who is an alcoholic in working with alcoholics as patients.

Whether or not she is a member of Alcoholics Anonymous, she is bound to share her liability with the alcoholics she nurses, either on a conscious or on an unconscious level. From this viewpoint, therefore, her line of communication with alcoholics is not professional. Yet in nursing duty she must try to establish a professional line of communication which, because based mostly on personal assets, calls for large amounts of free emotional energies. Repeated observation indicates that the nurse's attempt to reconcile professional and nonprofessional attitudes has a high liability to failure. In all likelihood, this attempt adds a new conflict to the old ones, with renewed drain on the nurse's emotional reserves. When dutybound to act professionally, either her defenses against the urge to drink weaken or an ill-concealed nonprofessional attitude takes the place of professional nursing. Dangers then arise for the alcoholic nurse as well as for the alcoholic being nursed.

The following propositions, based on fundamental principles of mental economics, summarize the above discussion:

1. In Alcoholics Anonymous and in some other lay approaches, the individual member gives the alcoholic as much help as he receives. The success of treatment is based on this equilibrium.

2. In a professional relationship, the therapist must be able and willing to give much and to receive nothing. The maintenance of the emotional equilibrium of professional personnel is the outcome of interactions between these indi-

viduals and society at large, with resulting availability of large emotional reserves for treatment purposes.

3. An alcoholic nurse, even if long sober, almost constantly faces difficulties in tolerating a situation of disturbed equilibrium in which the help she should give far exceeds what she receives.

These statements should not be construed as an attempt to demonstrate the superiority of professional treatment and professional personnel. Their aim is solely to clarify the differences between professional and lay approaches.

*What is the candidate's attitude toward the emotional problems of patients?* Extremes of excess interest and disinterest are equally undesirable. The adequate nurse seldom tries to elicit from patients conversation relating to emotions. However, patients often talk to her. She should be able to interrupt "confessions" which, almost intuitively, she senses to be damaging to the patient's emotional stability, insofar as the patient will later regret disclosures made in a state of turmoil.

The emphasis on emotional problems, so obvious in contemporary societies, can lead to an attitude characterized by almost total denial of body illness. The "it's all in your mind" type of nurse is not particularly helpful to patients. It hints of a grandiose and rather primitive conception of the powers of the human mind. To be aware that body and mind interact does not mean that disturbed emotions are the exclusive cause of body disorders, and certainly the nurse should not promote such an impression.

*Is the candidate interested in bedside nursing?* Some nurses are attracted by the scientific aspects of nursing, by theoretical discussions, and by administrative functions only because they are basically inhibited with patients. They are unable to be close to them, touch them, and so forth. Such attitudes are indicative of emotional problems which, related as they are to underlying deviant nutritional habits, are not compatible with the proper nursing of patients on a service specializing in these very problems.

*Does the candidate have strong feelings of inferiority (or superiority) about the practice of nursing in comparison with the practice of internal medicine, or psychiatry, or social work?*

An unrealistic hierarchical conception of professions is the symptom of unsolved intellectual and, sometimes, emotional problems. The well-trained nurse has her rightful place in a therapeutic team on an equal basis. The best qualified nurse understands the nature of this equality.

*Does the candidate believe that there are higher or lower activities in nursing?* The good nurse has no such illusions. The handling of a bedpan is not an activity of a "lower" quality than some administrative functions. The quality of a function is determined by the training brought to it and by the emotional attitude toward it. Strivings for power which are incompatible with ministering to the sick often underlie concepts relating to higher or lower activities in nursing and in professions in general.

*Has the candidate ever worked in close cooperation with social workers?* If so, has she gotten along well with them? How does she feel about social workers in general? If she has not teamed with social workers in the past, is the likelihood of good cooperation apparent?

The profession of social work has gone through changes as radical as those observed in the profession of nursing in recent years. From the handling of some apparently simple social problems, social workers have shifted their attention in part to the emotional problems of the individual. The experience thus gained has deepened their insights into the social maladjustments which are the projection of inner inadequacies. Experience has shown that an approach to social difficulties based on sound psychodynamic principles can supply to the disturbed person those corrective emotional experiences which may affect his inner equilibrium favorably and durably.

The cooperation between nurse and social worker is most helpful to any patient in the hospital and outside. In the eyes of the alcoholic, for example, the nurse often represents the temporary shelter and security of an unreal world. The social worker, on the other hand, represents the harsh realities of day-by-day life. This seems to be one reason why so many

hostilities are still polarized against the social worker. The emotional ambivalence toward maternal figures which governs the lives of many neurotic individuals, alcoholics among them, often expresses itself with love for nurse and hostility to the social worker. The nurse is often in a position to interpret the social worker to the alcoholic. Furthermore, nurse, exposed more than any other professional person to the exhausting challenges of the alcoholic, often needs the emotional support, well as the technical interpretation of the nurse-alcoholic relationship, which a skill psychiatric social worker can supply.

*How does the candidate envisage the special role of the nurse in the prevention or alleviation of the emotional difficulties of patients?* There is growing psychodynamic evidence that the main factor underlying emotional stability is a healthy and mutually rewarding mother-child relation. Regardless of her age, the nurse plays a maternal role for all patients and should be endowed with maternal traits. According to this viewpoint, maternal traits should be considered almost identical with feminine traits, and they are not dependent on the actual experience of motherhood. They are to be understood as the ability to tolerate and to interrupt betimes other people's pleasures and also their pains. The good mother is the one who knows how and when relief should be given to the child's pain; she knows also how and when the child's pleasures should be interrupted. In other words, she should be able to tolerate some pain in her child without guilt feelings and some pleasure without envious feelings. Besides these traits, emotional and physical stability, plus predictability of reactions to a given situation, should be considered maternal traits.

*Does the candidate prefer male or female patients?* There is little doubt that the ideal nurse should be maternal enough not to have preferences for male or female patients.

*How would the candidate react to attempts by patients to get information about her personal life?* The ability not to disclose too much about her personal life is of great importance. Usually it is linked with the ability to give some

harmless information about herself. In her contacts with the patient, the nurse should be able to keep control of the questions asked of her. This ability is definitely linked with her respect for other people and with her self-respect.

*What is the candidate's attitude toward success or failure?* Persons whose emotional constellations are similar to those operative in alcoholism and in other deviant nutritional habits often have a kind of "all or nothing" attitude toward success and failure. A minor error represents total failure and, conversely, a minor achievement might be fantastically magnified into a major success. The ability to see these matters in their proper perspective is best suited to the nursing of patients of this type.

*How does the candidate react to aggression?* Completely passive and completely aggressive reactions are equally undesirable if present all the time. Of course, occasional passivity or aggression are part and parcel of human nature. When required by the welfare of the patient, a nurse should be able to enforce discipline without experiencing guilt. Her actions should be guided by reason and not precipitated by the overwhelming pressure of her aggressive emotions.

*Does the candidate exhibit harmless infantile traits?* The ability to be a child occasionally and to interrupt the often painful performances of adult behavior should not be considered a handicap. Brief expressions of harmless infantile traits may greatly help a nurse to control those infantile traits which are harmful. The upbringing of many disturbed adults, among them the alcoholics, was highlighted by parental or cultural attitudes pointing to natural childhood behavior as basically "wrong" and leading to repression of harmless infantile traits.

*What is the candidate's attitude toward hierarchical transmissions of authority and nonphysical violence from top to bottom?* There is little doubt that authority and violence are often, even though wrongly, linked together and that retaliation for authoritarian attitudes of superiors is meted out to persons inferior in rank and, eventually, to patients.

The ideal nurse should be able to block violence at her level and to act more as a buffer than as a catalyst.

*Can the candidate distinguish between a friendly attitude toward a patient and being "friends" with the patient?* Can she keep sufficiently close to him and at the same time sufficiently distant from him? In a service for deviant eating and drinking habits, many patients are in good physical condition 2 or 3 days after their admission. They tend to become "friends." They attempt to engage the nurse in a close relationship which is dangerous both to them and to the nurse. The latter must have the skill to maintain the relationship on a professional level.

*Does the candidate apply the disease concept to alcoholism and obesity?* The alcoholic and the obese are suffering as a result of their search for excessive and forbidden pleasures. The disease connotation of their predicament is unusual insofar as the concept of disease is customarily linked with the concept of pain. Sooner or later persons in contact with alcoholics and obese individuals sense—consciously or unconsciously—that a search for forbidden and excessive pleasures, much more than overwhelming pain, is at the root of the trouble. Some professional people, nurses included, cannot accept without resentment the excessive pleasures of the addicts and react with ill-disguised hostility to the realities of the situation.

*Is the candidate tolerant of the patient's lack of cleanliness?* Alcoholics, especially in the early days of their hospitalization, are often unclean and unwilling to be clean. Sometimes this attitude is followed by an obsessive search for cleanliness. There is a type of woman, observed often in our culture, who was brought up with an obsessive repulsion against all that is not perfectly clean. She might feel "soiled" by the sexual experiences of marriage, and as a young mother she might be repelled by the soiled diapers of her baby. While this is not the place to discuss how and why this attitude develops, it can be stated that a rather tolerant attitude toward lack of cleanliness and an equally tolerant attempt to correct it are es-

sential in the nurse assigned to patients on a service for nutritional deviants.

*Is the candidate sensitive enough to the emergent needs of the neurotic to be able to satisfy them quickly if required?* Is she able to interrupt his pain swiftly when it appears to be overwhelming? On the other hand, is she free enough of impulsive traits to be able to delay the interruption of pain when it seems justified to do so in terms of long-range therapeutic plans? The attitudes explored by these questions are linked with the previously discussed maternal traits.

*Is the candidate so secure as to be able to discuss her inadequacies with colleagues and superiors?* If unable to cope with a given situation or with a given patient, is she able to delegate the task to a colleague? These admissions of individual shortcomings can occur only within a well-integrated and smoothly operating therapeutic team, where mutual respect is based on technical competence but even more on high standards of morality and of emotional adequacy.

*Can the candidate correctly interpret sexual or apparently sexual proposals by patients?* There is little doubt that some patients react to nurses with the most childish side of their personalities. Sometimes they try to touch them, eager for a physical contact which is more that of the child with the mother than of the man or woman with another adult woman or man. The correct interpretation of these attitudes is fundamental and should lead to tolerance not free from firmness.

*Is the candidate willing and able to give the patient all the explanations necessary to make clear the apparently mysterious ways in which a service of this type operates?* Is she a good listener? Because of the attempt to elicit corrective emotional experiences, the attitude of the treatment team often differs radically from all attitudes to which patients had been exposed in the past. Thus the service and the actions of its personnel are often interpreted as puzzling and mysterious. Nurses should have the ability

to clarify misunderstandings and define treatment goals. They should be able to listen with poise to the patient's excessive praise or criticism of other members of the therapeutic team, and be free to convey to colleagues and superiors the patient's feelings about them so that treatment may be modified accordingly.

### Summary

Services devoted to patients with deviant eating and drinking habits, separately or in combination, are growing in number. The professional nurse is a most important member of the therapeutic team in such services. Available are psychodynamic principles which should be applied to the evaluation and selection of nurse candidates for services of this type.

The specific criteria suggested are intended to help in identifying both suitable and unsuitable emotional traits in the nurse seeking assignment to such a service. The chief guiding principle is that the nurse should be a woman able to function as a symbolic feminine-maternal figure. This is based on the observation that patients with deviant eating and drinking habits usually experienced some disturbance in the early mother-child relationship, with resulting distortion of hunger-linked emotions, and that this maladjustment can be alleviated through healthy emotional contacts with adequate woman figures.

Among the most desirable specific characteristics, therefore, are: stable emotional makeup; feminine-maternal traits (not dependent on age or sexual experience); ability to cooperate in a treatment team with social workers particularly; acceptance of the patient's condition, in spite of its origin in pleasure-seeking activities (eating, drinking), as one requiring professional treatment; and ability to respond to the patient's occasional need for immediate relief from pain, or occasional aggressive and infantile conduct, without counter aggression and with appropriate mature behavior.

Nurse candidates who themselves have experienced addiction to alcohol or drugs require special psychiatric evaluation.

*Payments by the State welfare agency for clients needing care in nursing or boarding homes lag behind actual costs, and this, in turn, keeps many such homes from improving their standards to meet the State health agency requirements.*

## Costs of Care of Aged and Infirm Residents in Florida Nursing and Boarding Homes

By FERNE HOBSON BRITT, R.N., and MARGARET H. JACKS, A.B.

COSTS OF CARE in nursing and boarding homes for the aged and infirm were studied cooperatively by the Florida State Department of Public Welfare and the Florida State Board of Health in January, February, and March 1955. Both departments are interested in the development of adequate resources to care for persons whose physical and medical needs cannot be met in their own homes.

The Florida State Board of Health was given the legal responsibility of licensing and maintaining standards in nursing and boarding homes for the aged and infirm in 1953. Many of the residents in such homes receive aid through one of the public assistance categories administered by the Florida State Department of Public Welfare. Both agencies and the general public were aware that the licensing program of the State board of health and the accompanying attempt to raise standards in such homes were increasing the cost of operation. The increase in cost had been reflected in charges for care. There had been no paral-

lel increase in the amount of public assistance grants. As a result, there was a widening gap between the charges made by nursing and boarding homes and the amount recipients of public assistance were able to pay. Lack of information led the two agencies to study the cost of care in nursing and boarding homes.

In this joint study, the two agencies did not contemplate establishing a cost of care scale to be imposed on nursing and boarding home operators or establishing the amount which they should charge for care. We hoped that information on the cost of a standard of care that assured minimum adequacy could be established for the use of agencies and interested communities as a guide to the amount of public money needed to provide adequate care for recipients of public assistance and to provide adequate compensation for operators. We felt that the cost of acceptable care for the average patient should exclude extra services which various homes may offer at extra cost. The term "cost" in this study included a fair return on investment.

At best, the services at a nursing home are difficult to evaluate inasmuch as many of the usual yardsticks of achievement or failure cannot be used to measure the intangibles. We could tabulate types of activities and physical facilities. However, the tender loving care, the

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little "extras," the quality and effectiveness of the specific nursing activities which influence the health and happiness of the residents are more difficult to appraise. Fortunately, such elements do not necessarily contribute to costs. With these limitations in mind, the summary of our findings may be helpful.

### Plans for the Study

We recognized from the beginning that the study would be time consuming. Also it would be virtually impossible to make as complete a study as would be desirable because of staff limitations of both agencies. However, we thought that, through the cooperation of the two agencies at both State and local levels and with the cooperation of the operators of the homes, some valid information might be obtained.

The cost of care fell into two logical divisions, overhead expenses and services. Because of the varying needs of the person served as well as the difference in required equipment and facilities, costs in nursing homes vary decidedly from costs in boarding homes. Therefore, in the study, the average cost of acceptable care per patient in nursing homes and in boarding homes were determined separately.

In the study, for purposes of clarification and administration, nursing homes were defined as homes for the care of patients not requiring hospitalization. Many of the patients or residents of these homes have a chronic disease or are medical or surgical patients requiring further institutional care after hospital discharge.

Boarding homes for the aged were defined as being essentially for domiciliary and custodial care for aged persons, some of whom may require medical and nursing supervision.

The per patient cost of ordinary services, distinct from nursing care and housekeeping services, was determined and added to the average overhead charges.

In order to obtain cost figures for services, the nursing home operator was asked for data on the types of nursing and housekeeping services, the amount of time consumed in giving a particular service, and the number of times a specific service was performed.

Two schedules were developed for gathering

this information. Both contained questions on nursing and housekeeping functions. Schedule A was devoted primarily to questions on nursing functions with a few housekeeping items. Schedule B was primarily filled with housekeeping items, but a few questions on nursing functions were included. The forms were devised in this manner because, in many instances the size of a home and the number of the staff determined the types of services given by the workers in that particular home. Also, in some homes the nurses were doing the work ordinarily performed by maids, and the untrained workers were giving the nursing service. Because of this overlapping of services, each worker was asked to fill out both "A" and "B" for each of the 14 workdays of the study.

The time spent on services as reported by the homes on the schedules was compared with current State nursing home standards and with hospital standards. Although nursing homes could not be expected to provide services equal to hospital standards, such a comparison was useful in evaluating the difference in the quality of care. The same comparison was applied to boarding homes.

The average wage for nursing service was computed from the average wage for registered nurses, licensed practical nurses, aides, and orderlies throughout the State of Florida. The frequency with which licensed practical nurses, aides, and orderlies were hired to provide nursing service in ratio to the number of registered nurses hired to provide this service was established from personnel information obtained from the homes. The wages paid to the three classifications of employees was then averaged in the same ratio, and the hourly figure thus arrived at was accepted as the average hourly wage paid for nursing service. After the average wage and time figures were obtained, the number of hours of service provided was multiplied by the hourly wage to arrive at the average cost of service in a home.

To obtain figures on overhead costs, a schedule was prepared for entering detailed information on expenditures by the operator for capital outlay and fixed and semifixed charges of operation. This schedule C requested identifying information, the average number of patients, and minimum and maximum rates

charged. In addition, it asked for information on the property occupied; the number and types of buildings; the age of the buildings; if owned, the value, amount of mortgage and mortgage payments, taxes, insurance, maintenance, and depreciation; if rented, the monthly rent. This schedule also asked for costs of licenses, liability insurance, utilities, medicine and medical supplies, transportation, laundry, cleaning supplies, and telephone service. Information on the cost of replacement of furnishings and the expenditure for personnel was also requested. Although the cost of nursing personnel was specifically eliminated as an operating cost since the per patient cost of service was determined and included elsewhere, questions on all personnel were included on schedule C to obtain information on the average wage paid to nursing personnel. Wages paid to cooks, maids, maintenance men, and others, with the exception of nursing personnel, were considered as personnel costs in operating the home.

A simple form C supplement was also devised to help nursing home operators to keep a record of daily expenditures. Use of this form was not mandatory but was available to operators who did not use regular accounting systems. This part of the study was conducted during three winter months in order to include the cost of fuel, since, in most sections of the State, heat is not required during other months.

On the advice of two investment experts, 12 percent of total investment in real estate and 20 percent of investment in equipment were accepted as the annual cost for shelter and equipment, respectively.

Recognizing that financing costs of real property and equipment as well as maintenance costs of the home might remain fairly static, and that the cost of shelter, licenses, insurance, telephone service, and utilities were fixed charges which would change very little regardless of the number of beds occupied, the per capita cost of these items was derived by dividing the totals by the bed capacity of the home. Food, laundry, medical supplies, and transportation of patients were semifixed charges which would vary according to the number of beds occupied, and the per capita cost was derived by dividing those totals by the average number of patients receiving care during the period of the study.

In addition to capital outlay cost and fixed and semifixed charges, the total included an item for wages for the owner-operator. The amount was determined by the proportion of time spent on various duties as administrator, nurse, chauffeur, and so on. If the operator had responsibility for the home and also served as one of the nursing personnel, compensation for the time spent on administration was included but nothing for nursing service as that service was recognized elsewhere. If the operator gave full time to administrative and supervisory responsibilities and his services were not recognized elsewhere, an amount was entered to compensate him for full-time employment. If the owner were not the operator but merely had a financial investment in the enterprise, no salary was entered for him.

Originally, all homes licensed by the State board of health were to be asked to participate. At the time the licensing program was initiated, the State board of health had issued licenses to all homes which applied without regard to current standards. In the 1½ years after the licensing program had begun, there had been a concerted effort on the part of the State board of health staff to help the temporarily licensed homes to meet the standards. When the study was planned, many licensed homes had not met all requirements but in the majority there had been at least a degree of improvement and most homes were providing adequate care. We hoped that a large majority would participate in the study and that, in any event, there would be representation of all types of homes: large and small; nonwhite and white; urban, semi-urban, and rural; expensive and inexpensive.

Since the study was a joint venture, the local staffs of both the county health units and of the Florida State Department of Public Welfare were asked to meet with the operators to explain the aims of the study, the use of the schedules, and the procedures, and to help them to develop the data.

Because of the nature of their respective fields, the local health department staff was asked to work with the operators on service costs, and the local welfare department staff was asked to work with the operators in determining the cost of operating the home. When



the study was ended, completed schedules were collected and compilations made by State offices.

### Procedures Followed

At the time of the study there were 274 licensed homes. A letter from the State board of health was sent to the operators of these homes explaining the plans for the study and asking if they wished to participate. Exactly one-half of the licensed homes, or 137, replied in the affirmative.

Of the 137 homes signifying their willingness to participate, a number did not follow through because of the operators' unwillingness to do the necessary clerical work; a few were excluded because the limitation of time prevented the necessary personal interview with operators. More homes were omitted because a county health department did not have the necessary personnel to participate and support the program. A few were dropped because the operator and her personnel found it impossible to grasp the significance of the information desired for the survey.

In the final group of homes included in the study, the number of nursing homes and boarding homes were in almost identical relationship to the number of licensed homes in the State, and every type of home originally planned for was included.

Following the prearranged program, a public health nurse and a welfare visitor went together on an initial visit into each home to discuss the study and to plan with the operator for completing schedules. During their subsequent visits, the nurse each week and the welfare worker each month, discussed and answered questions about the schedules, and, finally, collected the completed schedules.

### Nursing Home Service Costs

An average of 2.3 hours of daily nursing service per patient was reported on the schedules from nursing homes. This ranged from 3.2 hours of nursing care in the better-equipped homes to a minimum of 1.2 hours of nursing care per patient in the less well-equipped homes.

Information obtained from the hospitals

throughout the State indicated that 3.4 hours of daily nursing care was the average standard in private and public hospitals.

The personnel required by the Florida State Board of Health standards for nursing homes would provide 2.8 hours per day for each patient, if followed.

To reconcile the discrepancy in these three standards, we consulted with members of the nursing profession and staff members of several hospitals. The consultants agreed that the hours of nursing service as reported by the homes was substandard and that a minimum of 2.6 hours per day of nursing service must be provided for acceptable care.

The average wage paid for registered nurses in Florida was found to be \$240 per month; for licensed practical nurses, \$155; and for aides, orderlies, and attendants, \$125 per month. When these wages were averaged together in the same ratio as personnel were employed to provide nursing service, the wage paid for nursing service averaged \$0.85 per hour.

Multiplying this figure by the 2.3 hours of nursing service reported by the homes, the per patient cost of nursing service averaged \$58.65 per month.

The compromise figure of 2.6 hours of nursing service with the same hourly wage, established the cost of adequate nursing service at a minimum level of \$66.30 per month.

Using the 2.8 hours included in the State board of health standards for nursing homes, the \$0.85 hourly wage established the cost of service at \$71.40 a month.

The amount of nursing care provided in a hospital could be accepted as the care required for the acutely ill. The 3.4 hours of nursing service (hospital standards) at the \$0.85 hourly cost of service established the minimum cost of service for acutely ill persons at \$66.70 a month.

### Boarding Home Service Costs

In the boarding homes, an average of 1.07 hours of nursing service per day was given to each patient. This was slightly lower than the Florida State Board of Health standards which require that personnel in boarding homes provide 1.4 hours of care. The consultants



agreed that no standard providing for less care was adequate.

In determining the average wage of persons providing care in boarding homes, only the wages paid to licensed practical nurses and aides and orderlies were considered; their average wage, in the ratio of the numbers employed in boarding homes, was \$0.75 an hour.

At the hourly wage of \$0.75, the 1.07 hours of service in the homes reporting established the cost of service at \$24 per patient per month. The \$0.75 hourly wage with the State board of health standard of 1.4 hours of service per day established the cost of adequate service to the patient in a boarding home as \$31.50 per month.

### Operating Costs

The original plan was to obtain completed schedules on operating costs for three consecutive months. When the completed schedules were evaluated, we found that some homes submitted figures for only 1 month, but indicated that the figures were average. These schedules were included. In some cases, 2 months' reports were received. In the majority of the homes, the 3 months' reports were averaged together to arrive at the average monthly cost for items included.

The only figure reported comparable with an acceptable standard was the figure for cost of food. Information from the nutrition staff of the State board of health established the per patient cost of food in the average nursing home at \$25.50 per month. The average amount spent for food was reported by the nursing homes as \$24.50, and by boarding homes as \$24.15.

Generally, a wage for the operator was not reported except when the operator did not act as one of the nursing personnel. From operators' wages reported and the comparative amount of time the operator spent on administrative duties, we determined that \$15 a month should be included as a per patient wage for the operator who spent full time on his duties as administrator. A \$5 per patient monthly cost was included for wages to the operator who acted in dual capacity as operator and nurse. There were no boarding homes

where the operator did not also give service; in those homes the \$5 per patient figure was included as the salary for the operator.

### Findings

The final compilation on a per patient monthly figure for capital outlay and fixed and semifixed charges of operating nursing homes was \$89. Included in this total was the wage paid to the owner-operator.

The overhead plus the monthly cost of 2.3 hours of patient daily nursing service as reported by the homes, \$58.50, equalled \$147.50, the average per patient cost of care in the nursing homes.

Adding the overhead to the monthly charge for 2.6 hours of nursing service, \$66.30, the compromise standard, established \$155.30 as the cost of adequate service in a nursing home.

These figures refer to the average patient. Acutely ill or extremely disturbed patients require additional nursing service. We felt that 3.4 hours of nursing service should be the minimum in such circumstances; thus the cost of care for acutely ill persons was established as \$176 a month.

Overhead in boarding homes, compiled by the same method as for nursing homes, was \$75.50. Adding this to the cost of 1.07 hours of care, \$24, resulted in \$99.50 as the reported cost of residence in boarding homes.

Using the same overhead figure of \$75.50 and substituting \$31.50 as the cost of the 1.4 hours of care required by State board of health standards established the cost of care in a boarding home with adequate custodial supervision at \$107 per patient.

The figures for nursing and boarding home care should be adjusted upward to insure adequate amounts being spent for food, in line with information that adequate food cannot be purchased for less than \$25.50 per patient.

The cost of care in the larger boarding and nursing homes was somewhat smaller than cost of care in the same type of home providing for fewer patients. In the nursing homes with a capacity of 10 or more patients, the average cost was \$140. In nursing homes providing care for fewer than 10 patients, the average cost was \$167. A similar but less marked

difference was obtained in figures from boarding homes. In those boarding homes caring for 10 or more patients, the cost totaled \$95. In boarding homes caring for fewer than 10 patients, the cost was \$104.50. Charges made by the nursing homes ranged from \$60 a month (the amount which can be paid from public assistance grants) to a maximum of \$400. Charges made in boarding homes ranged from \$40 to \$239 a month.

## Conclusions

Under the present Florida State Board of Health standards, 2.8 hours of nursing care are recommended for nursing homes. If the compromise figure of 2.6 hours of nursing care per person per day is accepted as the minimum amount of care needed to provide basic, essential nursing service, then the nursing homes which give an average of only 2.3 hours of nursing care fall below an acceptable standard. If the homes participating in the study are representative of all the nursing homes in the State, 77 percent of the homes provide a substandard amount of nursing service, and 23 percent provide adequate or above standard care. In the boarding homes, 69 percent fail to meet acceptable standards, and 31 percent meet or exceed the standards established by the State board of health as sufficient to provide adequate custodial care.

The total responsibility for the quality or quantity of care cannot be placed on the nursing home operators. Nursing home operators face many difficulties in the operation of these homes. Scarcely an operator in the State has not experienced difficulty at some time or other in obtaining qualified help. The lack of trained help is shown in the study. A large number of untrained employees provide different types of care to patients. Many nurses do not wish to work in homes giving care to the aged and chronically ill. Hospitals that can offer adequate salaries and satisfying working conditions appear to be absorbing desired trained personnel.

The many nursing activities in nursing homes provided largely by aides and other untrained help are reflected in the quality as well as the quantity of nursing care. Many capable wom-

en, despite their lack of preparation, are doing a worthy job. Lack of finances is one of the major reasons they are not prepared. There are 18 schools for the preparation of the professional nurse and 12 schools for the preparation of the licensed practical nurse in Florida. A plan for financial assistance for trainees would enable more women to take advantage of these facilities and would increase the number of available trained nursing personnel.

The financing of a nursing home requires initial investment and a continuing expenditure of time and money by the operator. To meet these financial demands and to insure a reasonable return on the investment, the operator must charge and receive a reasonable amount in payment for services. The figures from this study reflect a cost far above the sum currently provided by most State or local welfare funds for indigent patients.

Most of the homes adjust charges for the care of private patients who demand and are able to meet the cost of extra services. This is to be expected.

The figures established by the study, however, do not include the costs of these additional services. The cost of \$156 for nursing care and \$108 for boarding care reflects a standard of care which provides for only those services which are basic. To provide for any less results in suffering by the patient who must be cared for under substandard conditions.

Figures were not obtained on the proportionate number of patients who receive public welfare grants and the number of private patients in the homes. Many operators stated that they refuse to take patients for \$60 a month. In general, those same homes are the homes where standards are as high or higher than the standards required by the State board of health.

Apparently, this gap between the actual cost of care and the amounts which the recipients of public assistance can pay is a contributing factor in the low standards maintained in many homes.

It was not possible during the short period of the study to secure data on medical care provided in the homes, the number of patients now attending a clinic or those being seen regularly by a doctor. There has not been a systematic referral system developed between the homes

and the hospitals which provide clinic care to the patients. How much the establishment of such a referral system would reflect in additional and more adequate nursing care being required for patients is not known.

In addition to the cost of basic care in a nursing or boarding home and the problem of providing adequate medical supervision, there is a vital need for recreation and rehabilitation services for the aged and chronically ill. Only

a few homes provide a program of recreation or rehabilitation.

It is obvious from the findings of this study that additional help must be given in raising the standards of physical care and in providing additional services for patients who must be cared for in an institutional setting. It is equally obvious that with present payments for care and current limitations of available personnel it is not possible to appreciably raise standards.

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## *An Important Date*



Each month your health department and many hospitals, laboratories, schools, clinics, and homes receive a copy of PUBLIC HEALTH REPORTS, mailed to arrive on the 20th, or even earlier, depending upon geographic location of the subscriber.

Its pages carry timely research reports, analyses of current trends, new methods, concepts, and ideas, and topical reviews for the busy scientist, teacher, or public health worker. Capsule coverage of important public health meetings, like those of the American Public Health Association, help the PHR reader.

You can have your personal copy promptly. Use the subscription blank on the inside back cover. Let the 20th of each month be an important date for you, too.

### *Scheduled for early publication*

Abstracts—First Carville Leprosy Conference

Legislation on Air Pollution

Group Therapy For Delinquent Boys

Study of an Infectious Hepatitis Outbreak

National Tuberculosis Association Highlights

Rehabilitating Handicapped Children in Queens

# Heart Disease at Mid-Century

By PAUL D. WHITE, M.D.

**I**N THIS YEAR, still in the middle of the twentieth century, our hearts control much of our destiny. Diseases of the heart and arteries are responsible for a very large percentage of the illnesses and deaths in this country, even among children and young and middle-aged adults.

Despite the slowness with which we are moving in our efforts to meet this challenge, really great progress has been accomplished in several directions:

Cardiovascular syphilis has been almost wiped out as a result of the remarkably successful campaign for the prevention and early recognition and treatment of syphilis itself and the introduction of the antibiotics, especially penicillin. Once cardiovascular syphilis made up nearly 25 percent of all cases of heart disease; now it is well under 1 percent.

Rheumatic heart disease, at one time the most common type of all, is on the wane. In New England 30 years ago, it led all the other kinds of heart disease in prevalence. Now it is a poor third. This reduction is associated with

several factors, notably (a) the improvement in living conditions and (b) preventive measures to control infection by the hemolytic streptococcus, largely responsible for this type of heart disease.

Another advance of importance, achieved through remarkable development in surgery and splendid teamwork between physician and surgeon, is the rescue of a great many patients—thousands and thousands, afflicted with severe mitral stenosis. It is to be hoped that, with the reduction of rheumatic heart disease, much less need will exist in the future for this magnificent surgery of today.

Subacute bacterial endocarditis, formerly called malignant because it killed almost 99 percent of all patients, is now not only curable in about 75 to 80 percent, but can probably be prevented in many patients by the use of antibiotics. Moreover, as we reduce the incidence of rheumatic and congenital heart disease, subacute bacterial endocarditis will decline.

Other infections responsible for serious heart diseases in the past also are becoming scarce. Included among them is diphtheria, which used to be fatal in many patients because of its effect on the heart.

Chronic constrictive pericarditis, once incurable, is clinically reversible now in more than half the patients by the use of surgical techniques developed in the past 25 years. Its fundamental cause, tuberculosis of the pericardium, should be, along with tuberculosis in general, steadily on the road to oblivion so that in another generation there should be little or no demand for such surgery.

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*Dr. White is emeritus clinical professor of medicine, Harvard University Medical School. He is also executive director of the National Advisory Heart Council and president of the International Society of Cardiology. The accompanying comments were presented at the American Heart Association's dinner for opening the National 1956 Heart Fund Campaign, January 31, in Chicago.*

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# Ten leading causes of death, 1955

Death rate	Estimated rates per 100,000 population	Percent of total
352.0	Diseases of heart	37.9
147.6	Malignant neoplasms	15.9
106.6	Vascular lesions of CNS	11.5
55.6	Accidents	6.0
39.8	Certain diseases of early infancy	4.3
27.5	Pneumonia (except of newborn) and influenza	3.0
19.4	General arteriosclerosis	2.1
15.2	Diabetes mellitus	1.6
11.9	Congenital malformations	1.3
10.8	Cirrhosis of liver	1.2

Source: National Office of Vital Statistics, Public Health Service, Monthly Vital Statistics Report, vol. 4, No. 13, May 28, 1956

Thyrotoxicosis used to be the cause of heart disease in an occasional patient. Now, as a result of early recognition and much more satisfactory treatment of thyrotoxicosis, heart disease from this cause is rare.

Cor pulmonale, both acute and chronic, is on the wane as a result of the lower incidence of pulmonary embolism and the control of dusty air, indoors and out. How much harm smog may be doing is not known.

Even one of the more prevalent and serious kinds of heart disease, hypertensive heart disease, is now beginning to yield to treatment. The vigorous attack made on hypertension in the last two decades through surgery, diet, and the use of drugs has been extremely helpful.

## Problems for the Future

We haven't done much about the most important heart disease of all, namely, coronary heart disease, except that we can recognize it more readily than we used to, we know a little more about its course, and we can treat it more intelligently.

Congenital heart disease also remains as a great problem for the future. We have learned little about it, and we cannot prevent it. We know that it can be caused by german measles in the mother during the first 3 months of pregnancy, but there are certainly other factors and causes not yet discovered. The one bright spot with respect to congenital defects is that a number of them can be corrected, in whole or in

part, by surgery. This in itself is, of course, no small achievement.

Thus, progress against heart disease is still far from its goal: prevention of new cases and adequate treatment of heart disease where it exists. The major cardiac problems are congenital defects, high blood pressure, and coronary heart disease. I think, too, we must take cognizance of the problem of apoplexy, or to use the longer term, cerebral vascular disease, which afflicts so many people with or even without high blood pressure. Also, there is much to be done about the prevention of disease of the larger arteries, the aorta and the blood vessels of the legs in particular. Arteriosclerotic disease of the kidney is still another problem that needs much further study for the sake of prevention, recognition, and treatment. We have found that it tends to be one of the great hazards of old age. Perhaps with its control, healthy old age can be prolonged.

The need for applying, to the best of our ability, the knowledge we already have, in private practice and in community programs, deserves special attention. For example, it is known that the great majority of cardiac patients not only can work but should work. Physical exercise and mental activity are two of the best therapeutic measures for patients with heart disease. Like persons who are crippled

in other parts of their bodies, cardiac patients perform some of the best work in the world.

In the study of heart disease, the epidemiological approach offers opportunities not otherwise available. This approach needs to be used more extensively, not only in our own country but world wide. The study of the prevalence of the various kinds of heart disease in different groups and communities here and in foreign lands can be valuable both for the people of other countries and for those in this country. International teams should cooperate in the study of heart disease so that the situations in one country can be compared with those in another.

Heart programs are among the most important health campaigns ever planned. Though we may be not one-third of the way toward the maximum achievement, the years ahead are filled with promise. We can protect the hearts of the young and the middle-aged with something much more substantial than the casual advice to "take it easy," even if that is good advice, which it may not always be. If we pursue these programs with vigor, 10 years from now, I venture, we shall have remarkably reduced heart disease in the young and middle-aged throughout the world.

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## Staff College Course for Nurses

The fourth Federal Civil Defense Administration Staff College course for nurses is scheduled to be given at the FCDA National Headquarters, Battle Creek, Mich., September 24-28, 1956.

Special emphasis will be given to educational and training programs for nurses in civil defense.

Priority for enrollment will be given to nurses associated with schools of nursing, inservice training programs of hospitals, industry, schools, public health agencies, nursing organizations, and State or local civil defense offices. There is no tuition fee.

Nurses may obtain application forms from their local or State civil defense office, or by writing to the Staff College, National Headquarters, Federal Civil Defense Administration, Battle Creek, Mich.

# Group A Beta Hemolytic Streptococcus and Rheumatic Fever in Miami, Fla.

By MURRAY M. STREITFELD, Ph.D., MILTON S. SASLAW, M.D.,  
and SIMON D. DOFF, M.D.

A LONG-TERM STUDY of the relationship of group A beta hemolytic streptococcus to rheumatic fever in Miami, Fla., was undertaken to explain why rheumatic fever seems less severe and occurs less frequently in Miami than reported elsewhere (1-3). A survey of the prevalence, type, and virulence of this group of organisms and the immunological response of the host over a period of years, we felt, would yield a pattern of host-organism relationship which might enable us to answer this question.

Our preliminary observations from February through May 1953 revealed the presence of group A beta hemolytic streptococcus in the throats of 16.3 percent of 343 school children in Miami (4) at some time during the 4-month period. This suggested that factors other than the mere presence of this group of organisms are responsible for the apparent difference in rheumatic fever in Miami's "tropical" climate

(5, 6), as compared with other more northerly geographic localities.

Since the preliminary findings were limited to a 4-month study period, we continued to culture samples from the throats of these children for group A beta hemolytic streptococcus from October 1953 through May 1954 in order to obtain a more comprehensive picture of the prevalence of this group of bacteria in the Miami area. In addition, antistreptolysin O studies were performed to determine whether the strains of group A beta hemolytic streptococcus isolated evoked a systemic response. This is a report of the bacteriological and immunological data obtained during this 8-month period and a discussion of the significance of the results.

## Material and Methods

### *Throat Culture Studies*

During the 8-month period, October 1953 through May 1954, pairs of throat swabs were taken monthly from an average of 351 children attending grades 1 and 2 in three schools in Miami, for a total of 2,809 pairs of swabs. In all, 417 children were included in the study, and each child's throat was swabbed an average of 6.7 times.

The children came from grades 1 and 2 in the same three schools previously studied (4); these represented a low-income white group, a middle-income white population, and a mixed-income Negro group. The sample selected, though not truly random, represents the stable

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part, by surgery. This in itself is, of course, no small achievement.

Thus, progress against heart disease is still far from its goal: prevention of new cases and adequate treatment of heart disease where it exists. The major cardiac problems are congenital defects, high blood pressure, and coronary heart disease. I think, too, we must take cognizance of the problem of apoplexy, or to use the longer term, cerebral vascular disease, which afflicts so many people with or even without high blood pressure. Also, there is much to be done about the prevention of disease of the larger arteries, the aorta and the blood vessels of the legs in particular. Arteriosclerotic disease of the kidney is still another problem that needs much further study for the sake of prevention, recognition, and treatment. We have found that it tends to be one of the great hazards of old age. Perhaps with its control, healthy old age can be prolonged.

The need for applying, to the best of our ability, the knowledge we already have, in private practice and in community programs, deserves special attention. For example, it is known that the great majority of cardiac patients not only can work but should work. Physical exercise and mental activity are two of the best therapeutic measures for patients with heart disease. Like persons who are crip-

pled in other parts of their bodies, cardiac patients perform some of the best work in the world.

In the study of heart disease, the epidemiological approach offers opportunities not otherwise available. This approach needs to be used more extensively, not only in our own country but world wide. The study of the prevalence of the various kinds of heart disease in different groups and communities here and in foreign lands can be valuable both for the people of other countries and for those in this country. International teams should cooperate in the study of heart disease so that the situations in one country can be compared with those in another.

Heart programs are among the most important health campaigns ever planned. Though we may be not one-third of the way toward the maximum achievement, the years ahead are filled with promise. We can protect the hearts of the young and the middle-aged with something much more substantial than the casual advice to "take it easy," even if that is good advice, which it may not always be. If we pursue these programs with vigor, 10 years from now, I venture, we shall have remarkably reduced heart disease in the young and middle-aged throughout the world.

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### Staff College Course for Nurses

The fourth Federal Civil Defense Administration Staff College course for nurses is scheduled to be given at the FCDA National Headquarters, Battle Creek, Mich., September 24-28, 1956.

Special emphasis will be given to educational and training programs for nurses in civil defense.

Priority for enrollment will be given to nurses associated with schools of nursing, inservice training programs of hospitals, industry, schools, public health agencies, nursing organizations, and State or local civil defense offices. There is no tuition fee.

Nurses may obtain application forms from their local or State civil defense office, or by writing to the Staff College, National Headquarters, Federal Civil Defense Administration, Battle Creek, Mich.



in tables 1, 2, and 3. The highest percentage of positive cultures (15.4 percent) was obtained in May 1954 (table 1), the lowest (6.2 percent) in December 1953. The average percentage of positive cultures was 11.4 percent for the 8-month period and 6.2 percent for the 4-month period. The earlier 4-month study, of course, is not comparable quantitatively to the later 8-month survey.

Group A organisms were found at least once in 126 children, or 35.9 percent of the average of 351 children studied in the 8-month period

(table 2). This percentage was about the same for each of the three schools (table 3), and no significant differences were found in the number of isolates from first grade children compared with second graders. The average monthly recovery rate of group A beta hemolytic streptococcus was 8.0 percent.

Nine types of group A beta hemolytic streptococcus (table 4) were encountered in October 1953 through May 1954, in contrast to strains of type 12 only (with the exception of a single strain of type 28) in February through May

**Table 1. Grouping of beta hemolytic streptococcus isolated from 2,809 throat cultures in 417 children over an 8-month period, October 1953-May 1954, and comparison with February-May 1953, Miami, Fla.**

Month	Number of children		Number of children positive 1st time						
	Absent	Present and cultured	Group A	Other groups				Total	
				B	C	F	G		
Oct. 1953.....	35	382	24	4	2	---	4	34	
Nov. 1953.....	45	372	25	2	4	2	2	35	
Dec. 1953.....	46	371	4	2	---	---	1	7	
Jan. 1954.....	55	362	12	2	---	---	2	16	
Feb. 1954.....	78	339	17	2	3	---	2	24	
Mar. 1954.....	93	324	8	---	2	---	1	11	
Apr. 1954.....	89	328	15	1	3	---	2	21	
May 1954.....	86	331	7	---	7	---	2	16	
Total, Oct. 1953-May 1954.....		2,809	112	13	21	2	16	164	
Summary Feb.-May 1953.....		1,154	46	6	4	1	1	58	

Month	Number of cultures positive 2d, 3d, 4th, etc., times								Total positive cultures		
	Group A			Other groups					Total	Number	Percent
	1st time	New type	Same type	B	C	F	G	NG <sup>1</sup>			
Oct. 1953.....										34	8.9
Nov. 1953.....	1		7	1				1	10	45	12.1
Dec. 1953.....	1		9	3			3		16	23	6.2
Jan. 1954.....			13	2	2		1		18	34	9.4
Feb. 1954.....	3	3	13	2	2		2		25	49	14.5
Mar. 1954.....	2	2	12	2	3		4		25	36	11.1
Apr. 1954.....	3	2	14	4	4	1			28	49	14.9
May 1954.....	4		24	1	5		1		35	51	15.4
Total, Oct. 1953-May 1954.....	14	7	92	15	16	1	11	1	157	321	11.4
Summary Feb.-May 1953.....	1	1	11					1	14	72	6.2

<sup>1</sup> Nongroupable.

school population. A high-income group was omitted because such a group does not maintain year-round residence in Miami and therefore does not permit long-term observation. The first graders were new to the study. Only 189 second graders who had participated the year before, as first-grade students, were included. Written permission of the parents had been obtained for each child.

In all, 1,050 children were registered in grades 1 and 2 of the three schools. Thus, the 417 children in the study represented 39.7 percent of the total registration in these two grades.

As in the preliminary study (4), throat swabs were taken in duplicate from all children present in school during the mornings set aside for this phase of the work. The same technician performed all the swabbings within a 2-hour period. All the collected swabs were taken promptly to the laboratory for immediate plating. One swab was streaked on a plate of Difco blood agar base (DBAB) and the other on a plate of Difco neopeptone heart infusion agar (DNHI); both media were enriched with 4 percent defibrinated sheep's blood. DNHI had been used in May 1953 as an adjunct to DBAB to insure recovery of the highest number of positive isolates. Incubation, isolation, and subculturing of the cultures were carried out as previously. Grouping and typing were performed again under the supervision of Dr. Elaine Updyke at the Streptococcus Laboratory, Communicable Disease Center, Public Health Service.

No attempt was made to obtain cultures from the throats of children absent on the days set for study. However, the school nurses checked the reason for absence in most instances.

#### *Antistreptolysin O Studies*

Blood samples were taken simultaneously with throat swabs every 2 months. The serums were kept in deep freeze until the end of the study, when antistreptolysin O titer determinations were made using a single lot of commercial Difco Bacto streptolysin O reagent. In all, 996 serums from 356 children were tested by standard procedure (7) at titers of <12, 12, 50, 100, 125, 166, 250, 333, 500, 625, and 833.

The bacteriological findings were classified into four categories as follows:

1. Serums from children whose throats yielded no beta hemolytic streptococcus or group B beta hemolytic streptococcus only. The latter group was included in this category because it does not produce streptolysin O (8).

2. Serums from those with nontypable strains of group A beta hemolytic streptococcus, either alone or in combination with other groups of beta hemolytic streptococcus.

3. Serums from children bearing typable strains of group A beta hemolytic streptococcus found at least once, either alone or in combination with other groups of beta hemolytic streptococcus.

4. Serums from children from whom group C or group G beta hemolytic streptococcus, or both, were recovered. Some strains of these groups produce streptolysin O (8).

In order to correlate and evaluate our bacteriological and serologic findings, an antistreptolysin O index (9) was established for each bacteriological category. The antistreptolysin O titers were assigned numerical rank from 1 to 11, respectively. The index was calculated according to the following formula:

Where R=numerical rank and S=number of samples for the particular rank:

Antistreptolysin O index=

$$\frac{(R_1 \times S_1) + (R_2 \times S_2) + \dots + (R_{11} \times S_{11})}{\text{Total samples per category}}$$

Average peak titers were calculated for each of the four bacteriological categories and for the total number of children studied. The peak titer for each child was the highest antistreptolysin O level obtained during the study.

The antistreptolysin O index has the advantage of overcoming excessive weighting caused by small numbers of samples at high titer levels. Average antistreptolysin O titers are included for comparative purposes because average computations of titers are in common usage.

#### **Results**

##### *Throat Culture Studies*

The groups and types of beta hemolytic streptococcus isolated from the throats of the children studied from October 1953 through May 1954, together with a summary of the findings for February through May 1953 (4), are shown

tures isolated on each of the two media used during the 8 months of the study showed that had a single culture plate been used we would have failed to recover approximately one-third of the total beta hemolytic streptococci and one-third of the group A organisms isolated. Both media were found to be equally effective in the isolation of beta hemolytic streptococci and of group A organisms. Present studies are being conducted to determine the effect of streaking the initial swabs on three plates.

Numbers of colonies of beta hemolytic streptococcus present on initial plates were recorded. Approximately one-fifth of all children with group A organisms recovered from their throats yielded more than 10 colonies on at least one

of the 2 initial plates; four-fifths had under 10 colonies.

Some strains that showed alpha hemolysis on initial surface plating were found to give beta hemolysis on subsurface culturing. The failure of these strains to produce streptolysin S probably explains the absence of surface beta hemolysis, which depends on the formation of this lysin. On the other hand, subsurface beta hemolysis, the criterion for classifying a beta hemolytic streptococcus, is due to the formation of the oxygen-labile streptolysin O (10).

Table 6 lists children from whom the different groups of beta hemolytic streptococcus were isolated, according to the number of throat specimens cultured for each child. Higher

**Table 3. School distribution of group A beta hemolytic streptococcus, October 1953–May 1954, Miami, Fla.**

School	Average number of children studied	Children with group A		Total number of cultures taken	Total group A isolates	
		Number	Percent		Number	Percent
K.....	148.4	54	36.4	1,187	98	8.3
C.....	77.3	25	32.3	618	50	8.1
D.....	125.5	47	37.5	1,004	77	7.7
Total.....	351.1	126	35.9	2,809	225	8.0

<sup>1</sup> In 7 of these children, changes in types or typability occurred, making a total of 133 different strains of group A beta hemolytic streptococcus isolated (37.9 percent).

**Table 4. Types of group A beta hemolytic streptococcus isolated from 2,809 throat cultures in 417 children over an 8-month period, October 1953–May 1954, and comparison with February–May 1953, Miami, Fla.**

Month	Typable group A new isolates (1st time)										Subsequent typable group A isolates					
	1	3	4	12	23	28	31	33	44	Total	1	3	4	12	28	Total
Oct. 1953.....				2						2						
Nov. 1953.....		1	2	2	1	3		1		10				1		1
Dec. 1953.....				2						2		1		2		3
Jan. 1954.....				13						3		1	1	2	1	5
Feb. 1954.....			3	3				1		7		1	1	1	1	4
Mar. 1954.....			2	1			1		1	5		1		2		3
Apr. 1954.....	8		3				1			12				2		2
May 1954.....	3			1						4	6		1	2		9
Total.....	11	1	10	14	1	3	2	2	1	45	6	4	3	12	2	27
Summary Feb.–May 1953.....				25		1				26				1		1

<sup>1</sup> Includes 1 case of double infection with nontypable group A as second organism.

<sup>2</sup> Includes from table 2: At; At + Ao; At (change to group A); and At (type change).

Table 2. Group A beta hemolytic streptococcus isolated from 2,809 throat cultures in 417 children over an 8-month period, October 1953–May 1954, Miami, Fla.

Month	Number of children cultured	Number of children with group A for the first time							
		Ao	At	At + Ao	Change to group A		Total		
					Ao	At	Number	Percent	
Oct. 1953									
Nov. 1953	382	22	2					24	6.3
Dec. 1953	372	16	9					26	7.0
Jan. 1954	371	2	2				1	5	1.3
Feb. 1954	362	9	2		1			12	3.3
Mar. 1954	339	13	3	1				20	5.9
Apr. 1954	324	5	3	1	2	1		10	3.1
May 1954	328	6	9		1	1		18	5.5
	331	5	2		2	2		11	3.3
Total	2,809	78	32	12	7	17		126	35.9
Average per month	351.1								4.5

Month	Group A type changes		Total new group A isolates		Number of cultures positive 2d, 3d, 4th, etc., times				Total positive group A cultures	
	Ao	At	Number	Percent	Ao	At	Total		Number	Percent
							Number	Percent		
Oct. 1953										
Nov. 1953			24	6.3					24	6.3
Dec. 1953			26	7.0	6	1	7	1.9	33	8.9
Jan. 1954			5	1.3	6	3	9	2.4	14	3.8
Feb. 1954			12	3.3	8	5	13	3.6	25	6.9
Mar. 1954	1	2	23	6.8	9	4	13	3.8	36	10.6
Apr. 1954	1	1	12	3.7	9	3	12	3.7	24	7.4
May 1954	1	1	20	6.1	12	2	14	4.3	34	10.4
			11	3.3	15	9	24	7.2	35	10.6
Total	3	4	133	38.0	65	27	92	26.2	225	61.0
Average per month				4.7				3.3		8.0

Ao=nontypable group A beta hemolytic streptococcus; At=typable group A beta hemolytic streptococcus.  
<sup>1</sup>The 45 typable cases in these 4 columns are listed as total new isolates in table 4.

1953. Although type 12 predominated during the 8-month study and occurred in 26 instances, types 1 and 4 also were found frequently, type 1 in 17 and type 4 in 13 cases.

In 60 children, group A organisms were recovered 2 to 7 times during the 8-month period (table 5). Both typable and nontypable organisms were isolated from 8 children. In 8 other children, a strain of group B, C, F, or G beta hemolytic streptococcus was isolated, as well as a typable or nontypable strain of group A.

Of the 58 children who had beta hemolytic

streptococci in their throats during the pilot study, only 29 could be included in the 8-month study. Of these 29 children, 21 (72 percent) continued to show the presence of beta hemolytic streptococci in their throats; 14 (48 percent) maintained the same type or group of organism; 5 had a different organism, and 2 had two different organisms. Eight were negative for beta hemolytic streptococcus. Fourteen of the twenty-four children with group A streptococcus in the first year continued to carry the same group of organisms in the second year.

A comparison of the number of positive cul-

percentages of positive cultures recovered from those children from whom smaller numbers of swabbings per child were taken may reflect absenteeism due to streptococcal throat infections. However, the numbers are too small within each category to be interpreted finally.

### *Antistreptolysin O Studies*

Table 7 shows the antistreptolysin O titers in relation to bacteriological categories, and gives the average antistreptolysin O titer and

index for each bacteriological category. The antistreptolysin O index (4.6) of children with group A beta hemolytic streptococcus was elevated over the index (3.5) of children from whom no beta hemolytic streptococcus or only group B was recovered. Although children with typable strains of group A had a higher average antistreptolysin O titer than those with nontypable strains of group A, the antistreptolysin O index was the same for both. Children from whom groups C or G organisms, or both

**Table 6. Relationship between number of cultures per child and frequency of recovery of various groups of beta hemolytic streptococcus**

Number of months specimens were taken	Number of chil- dren cultured	Total cultures	Number of chil- dren negative	Number of children positive by number of months each child was positive							Positive cultures	
				1	2	3	4	5	6	7	Number	Percent
Group A												
8.....	212	1,696	143	34	20	5	5	3	0	2	138	8.1
7.....	89	623	57	19	10	3	-----	-----	-----	-----	48	7.7
6.....	37	222	26	7	4	-----	-----	-----	-----	-----	15	6.8
5.....	26	130	16	5	3	2	-----	-----	-----	-----	17	13.1
4.....	16	64	12	1	3	-----	-----	-----	-----	-----	7	10.9
3.....	12	36	12	-----	-----	-----	-----	-----	-----	-----	0	-----
2.....	13	26	13	-----	-----	-----	-----	-----	-----	-----	0	-----
1.....	12	12	12	-----	-----	-----	-----	-----	-----	-----	0	-----
Total.....	417	2,809	291	66	40	10	5	3	0	2	225	8.0
Group B												
8.....	212	1,696	200	5	4	-----	3	-----	-----	-----	25	1.5
7.....	89	623	88	1	-----	-----	-----	-----	-----	-----	1	.2
6.....	37	222	36	1	-----	-----	-----	-----	-----	-----	1	2.7
3.....	12	36	11	1	-----	-----	-----	-----	-----	-----	1	8.3
Total.....	417	2,809	402	8	4	0	3	-----	-----	-----	28	1.0
Group C												
8.....	212	1,696	190	15	4	1	12	-----	-----	-----	34	2.0
7.....	89	623	87	1	1	-----	-----	-----	-----	-----	3	3.4
6.....	37	222	35	2	-----	-----	-----	-----	-----	-----	2	5.4
Total.....	417	2,809	391	18	5	1	2	-----	-----	-----	39	1.4
Group F												
8.....	212	1,696	210	2	-----	-----	-----	-----	-----	-----	2	.1
4.....	16	64	15	1	-----	-----	-----	-----	-----	-----	1	1.6
Total.....	417	2,809	414	3	-----	-----	-----	-----	-----	-----	3	.1
Group G												
8.....	212	1,696	203	17	2	-----	-----	-----	-----	-----	11	.6
7.....	89	623	83	2	3	-----	-----	-----	1	-----	14	2.2
6.....	37	222	34	1	2	-----	-----	-----	-----	-----	5	2.3
4.....	16	64	15	1	-----	-----	-----	-----	-----	-----	1	1.6
Total.....	417	2,809	398	11	7	-----	-----	-----	1	-----	31	1.1

<sup>1</sup> Includes 2 children who, on 1 occasion, were found to have group A organisms plus organisms of another group simultaneously. In table 1 these children are listed in group A columns only, thus accounting for apparent discrepancies in numbers of cultures of groups other than group A.

<sup>2</sup> Includes 1 such child as above.

Table 5. Sixty children with repeatedly positive throat cultures, October 1953-May 1954, Miami, Fla.

Case No.	1953			1954				
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
1003	Neg.	Neg.	Neg.	Neg.	Ao	Neg.	Neg.	Ao
1006	Abs.	Neg.	Neg.	Neg.	Abs.	Abs.	Ao	Ao
1007	Neg.	Neg.	Neg.	Neg.	A33 + Ao	Ao	Ao	Ao
1009	Neg.	Neg.	Neg.	Neg.	A12	Abs.	A12	A12
1024	Neg.	Neg.	Neg.	Neg.	A12	Neg.	Neg.	Neg.
1027	A12	A12	A12	Neg.	A12	A12	A12	A12
1033	Ao	Neg.	Neg.	Neg.	Neg.	Neg.	Ao	C
1055	Neg.	A12	A12	Neg.	Ao	Ao	Ao	Neg.
1063	Abs.	Neg.	Neg.	Neg.	Neg.	Neg.	A1	A1
1064	Neg.	Neg.	Neg.	Neg.	A4	Neg.	Neg.	A4
1106	Neg.	Ao	Neg.	Neg.	Ao	Trans.		
1113	Ao	Ao	Ao	Neg.	A12	A12	A1	A1
1116	Neg.	Neg.	Neg.	Neg.	C	Neg.	A1	A1
1117	Neg.	Ao	Neg.	Ao	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
1124	C	Neg.	Neg.	Neg.	Ao	Neg.	Neg.	Ao
1126	Neg.	Ao	Neg.	Ao	Neg.	Trans.		
1133	Neg.	Neg.	Neg.	Neg.	Neg.	Abs.	A1	A1
1135	Ao	Ao	Neg.	Ao	Ao	Neg.	Neg.	Neg.
1140	Neg.	Neg.	Ao	Ao	Ao	Neg.	Neg.	Neg.
1144	Neg.	Ao	Neg.	Ao	Ao	Neg.	Neg.	Neg.
1151	Neg.	Abs.	Abs.	Ao	Neg.	Neg.	Neg.	Neg.
1169	Neg.	Neg.	Neg.	Neg.	A4	Neg.	Neg.	Neg.
1173	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	A1	A1
1183	Neg.	Neg.	Neg.	Neg.	Neg.	Abs.	A1	A1
1309	Neg.	Neg.	Neg.	Neg.	Ao	Neg.	A44	Neg.
1314	Neg.	Neg.	Ao	A12	Neg.	Neg.	Ao	Ao
1315	Neg.	A12	A12	Neg.	Ao	Neg.	Neg.	Neg.
1317	Neg.	F	Ao	Neg.	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
1320	Ao	Neg.	Neg.	Ao	Neg.	Neg.	Neg.	Ao
1334	Neg.	A4	Neg.	A4	Neg.	Neg.	Neg.	Ao
1344	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
1357	Neg.	Ao	Neg.	Neg.	Neg.	Ao	Ao	Neg.
1360	Neg.	A28	Neg.	Neg.	Neg.	Neg.	Ao	Trans.
1368	Neg.	Ao	Ao	Neg.	A28	Trans.		
1371	Neg.	Ao	Ao	Neg.	Abs.	Neg.	Neg.	Neg.
1373	Neg.	Neg.	Neg.	Ao	Neg.	Ao	Ao	Neg.
1388	Neg.	A3	A3	A3	A3	A3	Neg.	Neg.
1389	Abs.	Neg.	Neg.	Ao	Neg.	Ao	Abs.	Neg.
1609	Ao	Ao	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
1611	Ao	Ao	Neg.	Neg.	Neg.	Abs.	Neg.	Neg.
1619	Neg.	Neg.	B	Neg.	Neg.	Neg.	Neg.	Neg.
1620	Neg.	Neg.	Neg.	Neg.	Ao	Neg.	Ao	Neg.
1622	Neg.	Ao	Ao	Neg.	Ao	Ao	Ao	Neg.
1626	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
1628	Neg.	Neg.	A12	Neg.	Neg.	Abs.	Ao	Ao
1640	Ao	Neg.	Neg.	A12	Neg.	Ao	Neg.	Neg.
1656	Neg.	B	Neg.	Neg.	Ao	Neg.	Neg.	Neg.
1660	Neg.	Ao	Ao	Neg.	Neg.	Neg.	Ao	Ao
1673	Neg.	Abs.	Neg.	Neg.	Ao	Neg.	Neg.	Neg.
1675	Neg.	Neg.	Neg.	Ao	Abs.	Ao	Ao	Neg.
1684	Neg.	Neg.	Neg.	A12 + Ao	Neg.	Neg.	Ao	Neg.
1685	Neg.	Ao + G	Ao	Neg.	Ao	Neg.	Ao	Neg.
1694	Neg.	Neg.	Neg.	Neg.	Ao	Neg.	Neg.	Ao
1695	Neg.	Neg.	Neg.	Neg.	Abs.	Ao	Neg.	Neg.
1702	Ao	Ao + G	Neg.	Neg.	Neg.	Ao	Ao	Neg.
1703	Neg.	Neg.	Neg.	Neg.	Neg.	C	Ao + C	
1707	Neg.	Ao	Neg.	Ao	Abs.	Neg.	Ao	Ao
1709	Neg.	Neg.	Neg.	Neg.	Neg.	Abs.	Ao	Ao
1718	Neg.	Neg.	Neg.	Ao	Ao	Neg.	Neg.	Neg.
1742	Ao	Ao	Neg.	Abs.	Abs.	Neg.	Neg.	Neg.

<sup>1</sup> Withdrawn from study.

Ao=nontypable group A beta hemolytic streptococcus (ABHS); A1=type 1; A3=type 3; A4=type 4; A12=type 12; A28=type 28; A33=type 33; and A44=type 44 ABHS; B, C, F, and G each designates a beta hemolytic streptococcus group.

Neg.=negative; Abs.=absent; Trans.=transferred.

schools in Dade County, Fla., further indicate that this rate can be applied to the entire school population in the 6- to 9-year age group.

The streptococcal recovery rate must be considered minimal since no throat swabs were taken from absentees and no data on therapeutic use of antibiotics were available. If many of the absences were due to streptococcal infections, collection of throat swabs from these children during their absence might have yielded a higher recovery rate.

Furthermore, the rate must be considered minimal for other reasons. The technical impossibility of swabbing the faucial surfaces in their entirety resulted in the loss of some organisms. The use of dry swabs as well as the time required to collect all specimens, return them to the laboratory, and plate them might have resulted in death of some streptococci. The mechanics of preparing streaked plates undoubtedly led to some loss. Some organisms probably failed to survive after plating, while others, lacking in streptolysin S, did not cause surface hemolysis, and therefore these colonies might have escaped recognition. Subsurface plating initially would have demonstrated organisms containing streptolysin O, but such a procedure was impractical in our study.

Finally, our observation that the use of a single initial throat swab and plate would have caused the recovery rate to appear 25-35 percent lower than it actually was leads us to speculate that had third, fourth, or even more initial throat swabs and plates been used, the rate might have been higher.

Despite these valid objections to accepting our recovery rate as a true index of incidence or prevalence, the figures observed provide irrefutable evidence of the minimum frequency of occurrence of beta hemolytic streptococci.

Before drawing any conclusions as to the significance of the presence of group A beta hemolytic streptococcus in such a large proportion of the children studied, let us consider three possibilities regarding the host-organism relationship in these cases.

1. Is group A beta hemolytic streptococcus a harmless inhabitant of the throat with no systemic effect on the host? We cannot definitely answer this question as yet. Our studies thus

far lead us to believe that in most cases this is not so. Antistreptolysin O determinations showed higher average titers and an increased percentage of high titers associated with the presence of group A beta hemolytic streptococcus, suggesting that the organisms found in the throat evoked a systemic response. School attendance records, observations at the time throat swabs were taken, and nurses' followups indicated that about half of the children with positive cultures had respiratory illnesses (colds, "virus infections," tonsillitis, bronchitis, pneumonia, ear infection) either immediately before, during, or after the time that their throat specimens were cultured. These records did not include data on therapy.

2. Does the finding of group A beta hemolytic streptococcus reflect an infectious process (clinical or subclinical)? If an elevation in antistreptolysin O titer is indicative of previous clinical or subclinical streptococcal infection, our overall serologic findings would support this hypothesis.

3. Does the finding of group A beta hemolytic streptococcus signify the postinfection carrier state? The postinfection carrier state may have existed in 24 of the 126 children from whom group A organisms were isolated. Streptococci were recovered from these 24 children during October 1953, the first month of the study, and we have no way of determining whether these were new isolates or whether they had persisted from previous months. In the remaining 102 children (26 percent) from whom streptococci were isolated for the first time after their throat cultures had been negative for at least 1 month, we may exclude the postinfection carrier state. The persistence of streptococci in the throats of children over a period of months may reflect either a continuing infectious process or the postinfection carrier state. Our current studies, in which we are attempting to correlate more closely the serologic with the bacteriological findings, may clarify this point.

It is significant that despite repeated recovery of beta hemolytic streptococci from their throats, none of the children in the three schools studied developed active rheumatic fever, nor was there a single case of scarlet fever.

Table 7. Antistreptolysin O (ASO) titers of 996 serums taken from 356 children, by bacteriological category of child

Numerical rank	ASO titer	Bacteriological category <sup>1</sup>								Total serums
		I		II		III		IV		
		Number of serums	Per cent	Number of serums	Per cent	Number of serums	Per cent	Number of serums	Per cent	
1-----	<12	99	16.6	5	2.5	5	4.6	1	1.1	110
2-----	12	157	26.3	22	10.8	28	25.7	10	11.5	217
3-----	50	77	12.9	28	13.7	8	7.3	23	26.5	136
4-----	100	75	12.6	41	20.2	10	9.2	15	17.3	141
5-----	125	72	12.1	38	19.2	16	14.7	10	11.5	137
6-----	166	91	15.1	47	23.2	23	21.1	16	18.4	177
7-----	250	13	2.2	17	8.4	6	5.5	9	10.4	45
8-----	333	4	.7	4	2.0	8	7.3	1	1.1	17
9-----	500	3	.5	0	-----	4	3.7	1	1.1	8
10-----	625	5	.8	0	-----	0	-----	1	1.1	6
11-----	833	1	.2	0	-----	1	.9	0	-----	2
Total-----		597	100.0	203	100.0	109	100.0	87	100.0	996
Number of children-----		223		70		34		29		356
Average number serums per child-----		2.7		2.9		3.2		3.0		2.8
Titers of 166 or above-----		117	19.6	68	33.5	42	38.5	28	32.2	255
Titers of 250 or above-----		26	4.4	21	10.3	19	17.4	12	13.8	78
Average ASO titer-----		81		119		134		120		100
Average peak ASO titer-----		97		134		209		138		119
ASO index-----		3.5		4.6		4.6		4.4		4.0

<sup>1</sup> I. Children with no beta hemolytic streptococci or group B only; II. children with nontypable strains of group A beta hemolytic streptococcus, either alone or in combination with other groups; III. children with typable strains of group A beta hemolytic streptococcus at least once, either alone or in combination with other groups; IV. children with group C or group G beta hemolytic streptococcus, or both.

<sup>2</sup> 25.6 percent.

<sup>3</sup> 7.7 percent.

groups, were isolated demonstrated approximately the same average antistreptolysin O titer and index as those with nontypable group A streptococcus. Analysis of the peak antistreptolysin O titers indicated that the average peak was lowest in children from whom no beta hemolytic streptococci were isolated, higher in those with group C and group G or nontypable group A streptococcus, and highest in children with typable strains of group A organisms.

The number and percentage of serums with titers of 166 and above, as well as those of 250 and above, are also listed for each of the 4 bacteriological categories. Where beta hemolytic streptococci were isolated, the percentage of high titers was greater than where these organisms were not recovered.

## Discussion

The present study confirms our preliminary impression (4) that the low incidence of rheumatic fever, when diagnosed in conformity with Jones' criteria (11), and of rheumatic heart disease in Miami, Fla. (1), cannot be attributed to the infrequency of group A beta hemolytic streptococcus in this "tropical" climate. The finding of group A beta hemolytic streptococcus in the throats of 126 of the total of 417 children (30.2 percent) or 35.9 percent of the average monthly attendance figure of 351 children in three Miami schools during the 8-month period, October 1953 through May 1954, demonstrates that those organisms were common in this area. Additional studies now in progress in 900 children attending the first three grades in 36 other



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## Departmental Announcement

Edmund Baxter has been appointed as the regional director of Region III, Department of Health, Education, and Welfare, Charlottesville, Va.

Mr. Baxter has approximately 20 years of Government service, mostly with the Department of Health, Education, and Welfare and its predecessor agency. He has served for the past 3 years as consultant for special institutions in the Office of the Secretary. Prior to that, he was in charge of the program under which allotments of critical materials were made to schools, colleges, hospitals, and welfare institutions.

Mr. Baxter is a graduate in public administration of the University of Louisville. He served during World War II as a naval officer in the Pacific.

A number of investigators (12-16) have implicated group A, types 12 and 4, beta hemolytic streptococcus in the pathogenesis of glomerulonephritis. None of the children, in either our pilot or present study, from whom type 12 or type 4 group A beta hemolytic streptococcus was isolated, developed clinical glomerulonephritis. The "nephritogenicity" of these strains is considered elsewhere (4, 17). The predominance of type 12 in both of our studies indicates that this type was common in the schools studied and did not represent an isolated "epidemic" in February through May 1953, when it was the only type recovered.

We are still investigating the significance of groups B, C, and G beta hemolytic streptococci in relationship to illness in Dade County. Groups C and G evoked at least one type of systemic response, as evidenced by the higher average antistreptolysin O titer of children harboring these groups of streptococci compared with that of children from whom no beta hemolytic streptococci or only group B streptococci were recovered.

When considered in terms of the rheumatic fever picture in Miami, Fla., our observations suggest that the low rate of the disease cannot be attributed to the following:

1. Infrequency of group A beta hemolytic streptococcus.

2. Difference in groups or types of beta hemolytic streptococci compared with those encountered in other areas.

3. Lack of immunological response of the host, as determined by antistreptolysin O titers.

The answer probably lies "in some alteration in the pattern of the etiological relationship presumed to exist between group A beta hemolytic streptococci and rheumatic fever" (4) other than variations in incidence, frequency, or type of organisms.

Variations in the virulence of the organism or differences in degree or pattern of the host's immunological response to the organism may be responsible for the low rheumatic fever rate in Dade County, Fla. Also to be considered in the pathogenesis of the disease is the possible role of a virus-streptococcal combination (18). All of these factors probably are influenced by geography and climate.

## Summary

1. Throat swabs were taken monthly from October 1953 through May 1954 from 417 children in grades 1 and 2 in three schools in Miami, Fla. In all, 2,809 pairs of throat swabs were collected, representing an average of 6.7 swabs per child and 351 children per month.

2. Group A beta hemolytic streptococcus was isolated from the throats of 126 (35.9 percent) of the children at least once during the 8-month period.

3. Nine types of group A beta hemolytic streptococcus were isolated; in order of frequency, these were types 12, 1, 4, 3, 28, 31, 33, 23, and 44.

4. One hundred eighty-nine children who participated in a pilot study (February through May 1953) were carried over into the present program. Of these, 29 had harbored beta hemolytic streptococci in the pilot study. Twenty-one (72 percent) continued to carry streptococci in their throats; 14 (48 percent) had the same group of beta hemolytic streptococcus or the same type of group A organism.

5. Sixty children harbored group A beta hemolytic streptococcus in their throats on more than one occasion during the 8-month study. Twenty-six of these children had participated in the pilot study; 8 had been positive for group A organisms; an additional child had carried a nongroupable organism.

6. The percentage of positive isolates was approximately the same in the first graders as in the second graders.

7. Antistreptolysin O titers of children with groups A, C, and G beta hemolytic streptococcus were higher than those of children from whom no beta hemolytic streptococci or only group B were recovered.

8. The findings are discussed from the standpoint of several possible types of host-organism relationship.

9. None of the children from whom group A beta hemolytic streptococcus was isolated developed active rheumatic fever or scarlet fever, nor was clinical glomerulonephritis noted among any of the children, including those from whom a strain of type 12 or type 4 group A beta hemolytic streptococcus was isolated.

10. The low rheumatic fever rate in Miami, Fla., is discussed in view of these findings.

shelter from the wind. When *Anopheles* enters a house, it nearly always enters from the leeward side.

He learned that malaria mosquitoes avoid sunlight, rarely bite in the daytime, and then only in the shade. Their larvae are easily frightened and for long intervals remain hidden under water.

He noted that the puddles in hoofprints of cows and horses were important producers of certain *Anopheles* species; that green algae on water surfaces harbored larvae; that some areas produced a species of *Anopheles* only at certain times; that thousands of mosquitoes traveled from the swamps to human settlements each and every night; and that the *Anopheles* seemed to know exactly where it wanted to go.

He disproved the theory that anophelines were brought into towns by strong winds blowing from the marshes. When traps set in a vacant house failed to attract mosquitoes, LePrince and his men, by sleeping there, proved that it was the mosquitoes' strong sense of smell and their liking for the odor of human perspiration that brought them to their victims. He observed that some people were more attractive to *Anopheles* than others.

He learned that mosquitoes were carried on the clothing of passengers who traveled for long distances in trains at night; that they would remain on a man's coat during a stiff wind; that they gained entrance to screened dwellings by being carried in on dark clothing, where they rested undetected.

Screening of dwellings in Gatun, Colon, Panama City, and elsewhere along the 40-mile stretch of the canal was carried out on a scale never before attempted anywhere. When LePrince ordered the headquarters of the Canal Commission screened, the architect, who was new to the tropics, joked about the fuss made over the screening and delayed following the order. A month later he was dead of yellow fever.

LePrince not only faced indifferent cooperation. He was ridiculed. His destruction of Santa Ana Park in Panama City aroused public hostility. He was called an insect chaser and a crackpot. But he permitted no obstacle to dampen his ardor for his task.

The long-awaited details of the yellow fever

and malaria campaigns were revealed to the world in 1916 when LePrince published "Mosquito Control in Panama." This report on what he had learned in the Canal Zone and Havana was to remain a bible for mosquito control workers for many years. It is still a classic guide on environmental controls for certain mosquito species.

In the introduction to LePrince's historic work, Dr. L. O. Howard, then chief of the Bureau of Entomology, United States Department of Agriculture, recalled a conversation with Gorgas and LePrince before they left for Panama.

Howard had asked the general whether he would send specimens of all Panama mosquitoes to the bureau for naming. The general replied: "I will assign Mr. LePrince to see that it is done." Whereupon, LePrince remarked, "I will have to do it soon, Doctor, for in a year or so there will be no mosquitoes there."

Another anecdote about LePrince was supplied by the renowned Public Health Service epidemiologist, Dr. Leslie L. Lumsden. Lumsden told of sitting behind LePrince at a meeting where someone reading a paper on malaria was quoting liberally from LePrince's book without attribution. Lumsden asked LePrince how he liked having his "stuff" used without credit. The old man's eyes shone. "Just fine, because then I know he thinks it's good."

LePrince was equally famous for his malaria successes in the United States. He continued his war against the mosquito from Public Health Service headquarters in Memphis. His brilliant achievements in the Caribbean had convinced the Service that malaria could be controlled economically in the continental United States.

During World War I, LePrince had charge of malaria control in 28 Army and Navy installations in the eastern and southeastern United States. His methods of mosquito control resulted in a malaria rate in the Army during World War I that was less than 1 percent of the rate in the Spanish-American War. The control achieved by LePrince and other Service engineers in the postwar period anticipated the industrial development of the southern States.

The Public Health Service loaned LePrince

## LePrince, Malaria Fighter

WITH HIS DEATH on February 10, 1956, at the age of 80 in Memphis, Tenn., Col. Joseph Albert Augustin LePrince ended his long fight against malaria and yellow fever. A Public Health Service sanitary engineer since 1914, he began his campaign against vector mosquitoes in 1901, in Havana, as a civilian assistant to Maj. Gen. William Crawford Gorgas. At a time when many still doubted the evidence adduced by Carlos Finlay, Dr. Walter Reed, Sir Ronald Ross, and others, LePrince insisted on all-out mosquito control. Thanks in large part to his pioneer services, malaria is no longer a disease of economic importance in the United States.

On learning of the death of LePrince, Assistant Surgeon General Mark D. Hollis, chief engineer of the Public Health Service, said:

"Joseph LePrince received many honors during his lifetime, but knowing him as I did, I am sure that his greatest pride came from the knowledge that his work helped to wipe out some of the deadliest scourges the world has ever known. He is a great and true inspiration to those who carry on his work today."

LePrince achieved international acclaim as the right-hand man of Gorgas in the control of tropical diseases in Cuba and the Panama Canal Zone while the canal was under construction. His name will be remembered in Mexico, Puerto Rico, and other parts of Central America as one who came to serve his fellow man and served him well. He was a practical humanitarian who left the world deeply in his debt.

Son of the man posthumously honored as the father of the motion picture, LePrince was born August 3, 1875, in Leeds, England. He came to this country at the age of 12. In 1901, 3 years after his graduation from Columbia

University with civil engineering and master's degrees, he boarded ship for Havana, Cuba, on a 60-day assignment that was to last 14 years. President Theodore Roosevelt had given Gorgas full power to make the mosquito-infested island safe for our occupation forces after the Spanish-American War.

In Cuba, LePrince directed the actual work that changed Havana from a death trap of yellow fever to a tourist mecca. Within 3 months, with 2 inspectors, and at a cost of less than \$5,000, he eradicated yellow fever by eliminating mosquito-producing sources. In the process, he conducted basic studies that were to serve generations to follow.

From 1904 to 1914, LePrince, as chief sanitary inspector of the Isthmian Canal Commission and as public health officer in Panama, applied his Cuban experience to rid the "Big Ditch" of tropical diseases. In an intensive 14-month engineering campaign, he and his field men charted rainfall curves, traced watercourses, drained waterholes, converted marshes, removed jungles, and attacked propagation areas with oils and larvicides. At the same time, he was busy organizing fumigation brigades and trying to win the cooperation of householders and local authorities.

A byproduct of the campaign was a series of brilliant ecologic experiments by LePrince on the flight range and breeding habits of the mosquito which contributed to the virtual elimination of the vector of yellow fever, *Aedes aegypti*, and of the anophelines, carrier of the malarial parasites.

LePrince discovered that anopheline mosquitoes will sometimes travel a mile though a half mile is their usual flight. He found that "Madam Anopheles," as he called his foe, seeks

# Mosquitoes and Encephalitis *in the* Irrigated High Plains of Texas

By FRED C. HARMSTON, B.S., GEORGE R. SHULTZ, B.C.E.,  
RICHARD B. EADS, Ph.D., and GEORGE C. MENZIES, M.S.

THE OCCURRENCE of human and equine encephalitis in the High Plains of northwestern Texas during 1940-50 and, particularly, the increased prevalence among humans in 1952 aroused the interest of local, State, and Federal public health officials. The possible relationship between conditions associated with the expansion of irrigation and the increase in encephalitis virus infections led to cooperative investigations in the Texas High Plains by the Public Health Service and the Texas State Department of Health during 1953-54.

Irrigated cropland on the Texas High Plains increased from 250,000 acres in 1940, to 1,860,000 acres in 1950 (1). Deep wells are the principal source of irrigation water for this area; the effluent from municipal sewage treatment plants is also used in some localities. The spectacular expansion of irrigation has caused

major changes in the population, in agricultural practices, and in the economy of the region.

Records of the Texas State Department of Health and those of the Animal Disease and Parasite Research Branch, Agricultural Research Service, United States Department of Agriculture, show that cases of human and equine encephalitis were reported from irrigated sections of the Texas High Plains during most years of the period 1940-54. Outbreaks of the disease in humans occurred in 1952 and 1954, when 23 and 32 cases, respectively, were reported; 16 cases were reported in 1944 and 11 in 1953. The reported equine cases ranged from 3 in 1942 to 26 in 1944; 25 cases were reported in 1952.

Preliminary surveys were made in the vicinity of Lubbock and Plainview during the period August-October 1953 to obtain information on mosquito populations and the factors involved in their production. These surveys indicated that mosquito problems of public health significance occurred in the Texas High Plains and that the problems were related to both agricultural and municipal use and disposal of water.

In 1954, detailed entomological-engineering investigations were conducted throughout the season in representative areas of the Texas High Plains to determine: (a) the kinds and relative abundance of adult mosquitoes in urban and rural localities; (b) the frequency with which mosquitoes were infected with encephalitis

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*Mr. Menzies died in January 1956 of rabies, probably contracted during the course of bat rabies investigations. At the time of his death he was senior entomologist, entomology section, Texas State Department of Health.*

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to Mexico in 1923 to develop malaria control in the oil fields. In 1927 he directed malaria control activities in the Mississippi River area for the American Red Cross. In 1935 he became consultant on malaria control to the Tennessee Valley Authority. He was called back to the Caribbean area in 1938 to assist the Puerto Rican Government in a serious malaria outbreak. In 1940, a year after his retirement from the Public Health Service, he helped solve malaria control problems resulting from the building of dams on the upper Mississippi River.

As the world grew to appreciate his efforts, LePrince received many honors. He held the greatly prized Ross Medallion awarded by the London School of Tropical Medicine. He received an honorary doctorate of science from Southwestern at Memphis in 1945. In 1951 the National Malaria Societies chose him to receive the first Joseph Augustin LePrince Award,

named for him and bestowed on him because of his outstanding accomplishments in malaria control.

LePrince died in the Public Health Service Hospital in Memphis. He is survived by his widow, the former Julia Mercedes Lluria, of Havana, and by his son, four daughters, five grandchildren, and one great-grandchild.

LePrince closed his 1916 classic report with a prophetic statement, made in 1911 by James Bryce, Ambassador from England to the United States:

"In modern times most of the events of highest ultimate significance have been discoveries in the realms of nature or inventions in the realm of industry; and their magnitude is seldom known at first. Little was said of the discovery that mosquitoes are the carriers of yellow fever and the intermittent fevers, yet what immense consequences are already seen to flow from the determination of that fact!"

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## Training in Insect and Rodent Control

Training courses in insect and rodent control are being offered in Atlanta, Georgia, during September, October, and November 1956, by the Training Branch of the Communicable Disease Center, Public Health Service. These courses are based on the extensive experience of the Communicable Disease Center in investigations and operations in the vector control field and are primarily for personnel of Federal, State, and local health departments. Training in both the laboratory and the field is included, designed to give a working knowledge of the control of insects and rodents affecting the health and well-being of man.

A course in insect control, which gives principal attention to the control of mosquitoes, flies, and other insects occurring in and around homes and food-handling establishments, is scheduled for September 17-28, 1956.

Training in rodent control, October 1-12,

includes instruction in the control of domestic rodents and rodentborne diseases.

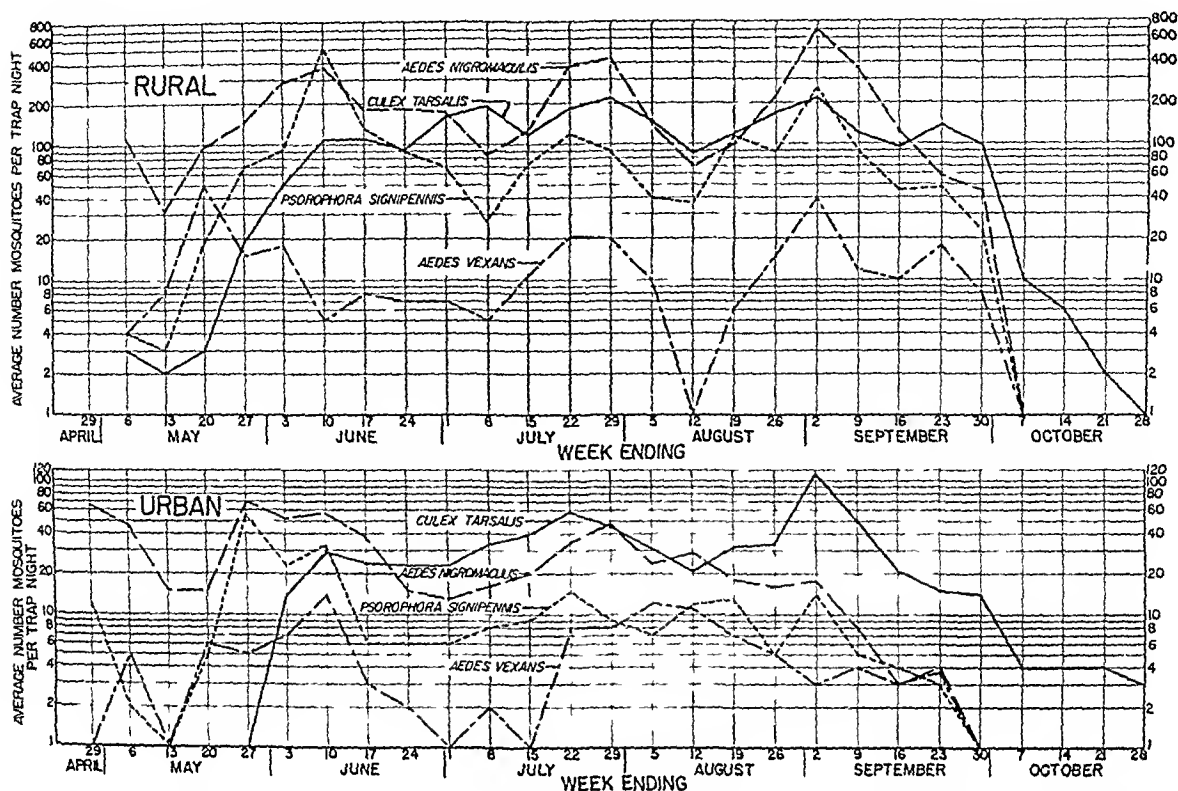
A course covering mosquito control will be given November 5-9, 1956.

A special advanced 2-week course in the biology and identification of arthropods of public health importance is scheduled for December 10-21, 1956. This course, which uses the extensive insect collection of the Communicable Disease Center, is particularly useful for entomologists and biologists and others interested in proper identification of arthropods of public health importance such as flies, fleas, ticks, and mosquitoes.

Other courses in insect and rodent control are scheduled for March, April, and May 1957.

Interested persons should apply through their organizations to the Chief, Training Branch, Communicable Disease Center, Public Health Service, 50 Seventh Street NE, Atlanta 23, Ga.

Figure 1. Seasonal abundance of adult female mosquitoes collected at rural and urban sites, Plainview and Hereford study areas, Texas High Plains, 1954.



were sampled by means of standard New Jersey light traps. Eleven traps, 5 urban and 6 rural, were operated from dusk to dawn at Plainview, Abernathy, Hereford, Hale Center, and Kress.

To determine the kinds and relative abundance of mosquitoes that attack man in the evening, biting collections were made at weekly intervals from July 20 to October 12 near the light trap sites in the town of Plainview and surrounding rural areas. The collections were made during 3 consecutive 15-minute periods beginning at sunset. Mosquitoes were caught by means of a killing tube or aspirator from the exposed legs of the collector. In contrast to the landing rate observations which are frequently made, these collections included only mosquitoes which had actually started to bite.

To obtain mosquitoes for encephalitis virus recovery tests, females of *Culex tarsalis* and other species were collected from diurnal resting shelters in urban and rural areas of Hale, Lubbock, and Swisher Counties from June 22 to October 26. The mosquitoes were collected

with an aspirator and transferred to small bobbinet cages. They were held overnight and then shipped alive by air express to the State health department laboratory in Austin, Tex. The cages containing the live mosquitoes were enclosed in an insulated cardboard carton along with two frozen gel units for cooling purposes. Shipping techniques were adapted from those described by Brennan and Mail (3).

The mosquitoes invariably arrived at the laboratory in good condition after a 4-hour trip from Plainview. Upon arrival, they were anesthetized, identified, macerated, and suspended in buffered broth. The suspension was inoculated into infant mice, young adult mice, or day-old chicks. Suspicious material was inoculated into guinea pigs from which blood specimens were taken 21 to 30 days later and tested by complement fixation for western equine, eastern equine, and St. Louis encephalitis viruses.

Detailed mosquito production studies were made between April 20 and October 29 on plots

viruses; (c) the specific conditions that resulted in mosquito production; and (d) the causes and possible corrections of these conditions.

The Texas High Plains

The High Plains of Texas cover approximately 20,000 square miles in the northwestern part of the State. They extend southward from the Canadian River Valley to the Pecos River Valley, a distance of about 200 miles. The region is bounded by an abrupt escarpment on all sides except the south, where it merges gradually into the lower, eroded plains bordering the Pecos River Valley. This vast tableland rises above the adjoining country by heights ranging from 50 to 300 feet. Its elevation above mean sea level varies from about 4,400 feet in the northwest to less than 3,000 feet in the southeast. The surface is flat to gently undulating, and has a generally uniform slope toward the east and southeast, averaging about 10 feet per mile.

Numerous playas, a few low hummocks, and small stream valleys provide the only prominent natural land features. Of these, the undrained natural depressions, or playas, are by far the most significant. The playas are scattered rather uniformly over the area, averaging about one per square mile. They range in size

from less than 10 to more than 2,000 acres, and average 20 to 30 feet in depth. The playas are usually dry during the winter months but may be flooded during the growing season by surface runoff and irrigation waste water.

The climate of the region is typically semi-arid, characterized by a dry atmosphere, hot summers, short, cold winters, and a large proportion of sunny days. The annual rainfall averages about 20 inches, with nearly three-fourths occurring during April through September. Evaporation losses are estimated at 99 percent of the average annual rainfall (2).

The irrigated area within the Texas High Plains comprises nearly 15,000 square miles and extends approximately 140 miles south from Amarillo. The predominant soil types throughout the irrigated areas are fine sandy loams and clay loams, both of which readily absorb water and therefore afford good vertical drainage. These soils are very productive under irrigation. The principal field crops are grain sorghum, cotton, small grains, alfalfa, and pasture. Irrigated truck crops, including potatoes, onions, and lettuce, are grown in some sections.

Methods

Between April 26 and October 28, 1954, adult mosquito populations in urban and rural areas

Table 1. Relative abundance of major mosquito species (females) in light trap collections, Texas High Plains, April 26–October 28, 1954

Species	Percentage of total specimens collected								
	Plainview		Hereford		Other localities <sup>1</sup>		All locations		
	Urban (1 trap)	Rural (4 traps)	Urban (1 trap)	Rural (1 trap)	Urban (3 traps)	Rural (1 trap)	Urban (5 traps)	Rural (6 traps)	Total (11 traps)
<i>Aedes nigromaculis</i> .....	36	46	6	10	12	45	19	44	41
<i>Culex tarsalis</i> .....	26	24	76	70	59	14	50	24	28
<i>Psorophora signipennis</i> .....	13	21	7	16	8	32	9	22	20
<i>Psorophora discolor</i> .....	9	4	<1	1	1	4	3	4	4
<i>Aedes vexans</i> .....	8	3	1	<1	1	3	3	3	3
<i>Culex quinquefasciatus</i> .....	2	<1	8	1	16	<1	11	1	2
<i>Aedes dorsalis</i> .....	5	1	<1	<1	2	1	3	1	1
Other species <sup>2</sup> .....	1	1	1	2	1	1	2	1	1
Total number of specimens.....	11, 047	189, 675	2, 911	4, 895	23, 364	24, 616	37, 322	219, 186	256, 508
Total number of trap-nights.....	120	402	98	130	437	82	655	614	1, 269

<sup>1</sup> Urban traps located at Lubbock, Abernathy, and Hale Center; rural trap located near Kress. <sup>2</sup> Includes *Anopheles pseudopunctipennis*, *Anopheles punctipennis*, *Culex erraticus*, *Culex erythrothorax*, *Culiseta inornata*, *Psorophora ciliata*, *Psorophora cyaneescens*, and *Uranotaenia syntheta*.



mosquito production studies were made in the following habitats associated with municipal sewage disposal: (a) the sewage lagoon at Abernathy, (b) the oxidation ponds at Petersburg, and (c) the sewage polluted streams at Plainview and Tulia.

### Adult Mosquito Populations

The relative abundance of the major mosquito species collected in 5 urban and 6 rural light traps is presented in table 1. A total of 256,508 females, representing 16 species, was taken during 1,269 trap-nights from April 26 to October 28. The average nightly collection of all species was 202 for all locations combined, 335 at Plainview, 34 at Hereford, and 92 for the other four localities together.

A total of 37,322 female mosquitoes was collected in the 5 urban traps. Of these, the predominant species were *C. tarsalis*, 50 percent; *Aedes nigromaculis*, 19 percent; *Culex quinquefasciatus*, 11 percent; and *Psorophora signipennis*, 9 percent. Of 219,186 females taken in the 6 rural traps, *A. nigromaculis* comprised 44 percent; *C. tarsalis*, 24 percent; and *P. signi-*

Figure 2. Mosquito production by habitat and source of water, Plainview study area, Texas High Plains, 1954.

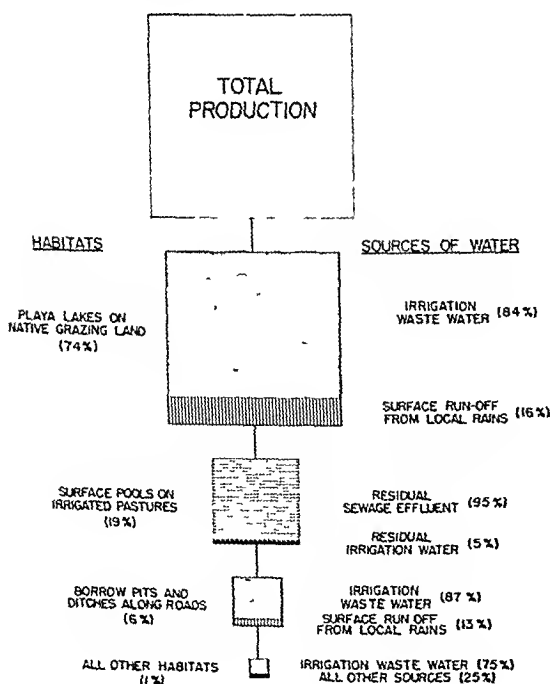
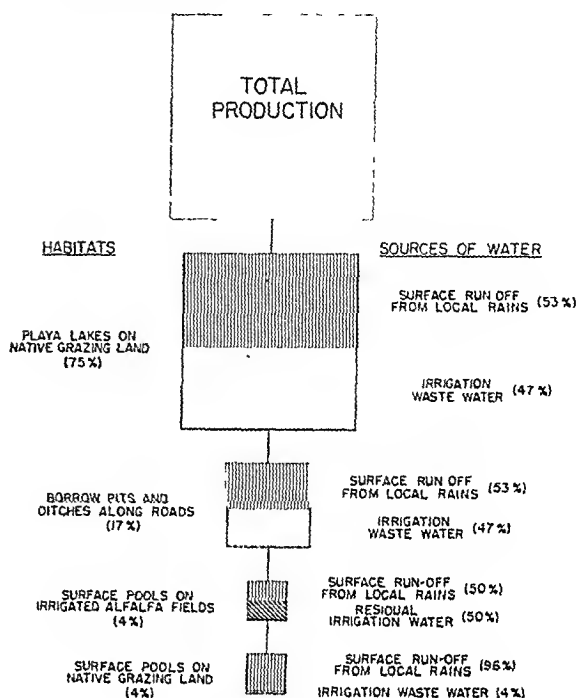


Figure 3. Mosquito production by habitat and source of water, Hereford study area, Texas High Plains, 1954.



*pennis*, 22 percent. The average nightly collection of all species in the rural traps was 357, as compared with 57 in the urban traps. The average collection per trap-night and the seasonal distribution of the major species for both urban and rural sites at Plainview and Hereford (the two principal study areas) are shown by weekly periods in figure 1.

The relative abundance of biting mosquitoes collected at weekly intervals on human hosts in the town of Plainview and in surrounding rural areas is shown in table 2. Of 2,404 mosquitoes taken in 98 collecting periods of 15 minutes each, *C. tarsalis*, the primary vector of western equine encephalitis, *A. nigromaculis*, and *Aedes vexans* were the principal species at both rural and urban sites. At the rural sites, the average attack rate for all species combined was 34 mosquitoes per period, and at urban sites, 15 mosquitoes. Both *A. nigromaculis* and *A. vexans* are severe pest mosquitoes and have been found naturally infected with western equine encephalitis (4, 5); in the laboratory they have been found to be efficient vectors of encephalitis virus (6, 7).

located in the vicinity of Plainview and Hereford. These plots were generally representative of irrigated areas in the Texas High Plains. At Plainview the study plots consisted of 22 sections (one square mile each), which included parts of the town and the surrounding agricultural area where diversified field crops were grown under irrigation. Sorghum and cotton were the principal crops and together comprised 77 percent of the total irrigated area (9,095 acres) on the plots. The combined acreage of alfalfa, small grains, pasture, corn, and Sudan grass accounted for the remaining 23 percent of the irrigated area. A small amount of pastureland on these plots was irrigated with treated sewage effluent. At Hereford the study plot included an area of approximately 6 square miles in which field and truck crops were grown under intensive irrigation. Sorghum and small grains were grown on 63 percent of the total irrigated area (3,395 acres) on the study plot, and truck crops including potatoes, lettuce, and onions covered 34 percent. Small acreages of cotton and alfalfa were grown under irrigation on the remainder of the plot. The furrow method of irrigation was employed on 82 percent of the irrigated cropland on the Plainview plots and on 94 percent of the irrigated acreage on the Hereford plot. Maps of

**Table 2. Relative abundance of mosquito species taken on human hosts within 45 minutes after sunset in weekly biting collections near the light trap sites, Plainview, Tex., July 20–October 12, 1954**

Species	4 rural sites <sup>1</sup>		1 urban site <sup>1</sup>	
	Number	Percent	Number	Percent
<i>Aedes nigromaculis</i> .....	626	37	92	12
<i>Aedes vexans</i> .....	562	34	514	69
<i>Culex tarsalis</i> .....	357	21	100	14
<i>Aedes dorsalis</i> .....	38	2	20	3
<i>Psorophora discolor</i> .....	34	2	1	<1
<i>Psorophora signipennis</i> .....	26	2	8	1
<i>Anopheles punctipennis</i> .....	16	1	0	0
<i>Culex erraticus</i> .....	5	<1	0	0
<i>Culiseta inornata</i> .....	1	<1	3	<1
<i>Culex erythrorhax</i> .....	0	0	1	<1
Total.....	1,665	100	739	100

<sup>1</sup> Forty-nine periods of 15 minutes.

**Table 3. Number of female mosquitoes processed for encephalitis virus isolations, Texas High Plains, June 22–October 26, 1954**

Species	Counties from which collected			Total
	Hale	Lubbock	Swisher	
<i>Culex quinquefasciatus</i> .....	1,625	1,647	52	3,324
<i>Culex tarsalis</i> .....	350	590	375	1,315
<i>Anopheles punctipennis</i> .....	0	52	0	52
<i>Anopheles pseudopunctipennis</i> .....	0	42	0	42
Total number of specimens.....	1,975	2,331	427	4,733
Total number of collections.....	14	16	4	34

the study plots were prepared showing the location and types of mosquito breeding places, location of wells and irrigation distribution systems, field boundaries, field acreages, crops, and methods and direction of irrigation.

Potential mosquito breeding places were arbitrarily classified into five types: playa lakes, surface pools, irrigation laterals, borrow pits and roadside ditches, and stream margins. All temporary water areas on the study plots were sampled for mature larvae and pupae following each flooding. The permanent and semipermanent water areas were sampled once each week. Each water area was sampled with a pint-size, white-enamel dipper; the number of dips taken was proportionate to the extent of the breeding area. When mature larvae were present, representative samples were collected for identification. During each inspection, the data obtained included: (a) the average number of fourth-instar larvae and pupae per dip, (b) an estimate of the total water area, (c) an estimate of the breeding area, and (d) the source of water.

In order to evaluate the relative mosquito production potential of the various habitats on the plots, production indexes were determined by use of the following formula:

Production index = (average number of fourth-instar larvae and pupae per dip) × (breeding area in acres).

In addition to the detailed investigations on the plots at Plainview and Hereford, weekly

with only 13 percent for the Plainview area. Waste water from irrigated fields accounted for 45 percent of the total mosquito production.

On the Plainview study plots, 36,510 larvae, comprising 12 species, were collected and identified (fig. 4). The most abundant species were: *C. tarsalis*, 44 percent; *A. nigromaculis*, 36 percent; *P. signipennis*, 6 percent; and *A. vexans*, 5 percent. Other species collected in smaller numbers included *Aedes dorsalis*, *Aedes sollicitans*, *A. pseudopunctipennis*, *A. punctipennis*, *C. quinquefasciatus*, *Culiseta inornata*, *Psorophora ciliata*, and *Psorophora discolor*. *C. tarsalis* was found in all types of habitats except irrigation laterals and was the predominant species in playa lakes, surface pools on pastures irrigated with sewage effluent, and the margins of the sewage polluted creek. *A. nigromaculis* was common in all habitats except the margins of the sewage polluted creek.

On the Hereford plot, 6,099 larvae, representing 5 species, were collected and identified (fig. 5). The principal species were: *C. tarsalis*, 65 percent; *A. nigromaculis*, 22 percent; and *P. signipennis*, 11 percent. These species were found in all types of habitats. Small numbers of *C. inornata* and *P. discolor* were also collected.

## Mosquito Production and Sewage Disposal

Mosquito breeding occurred in all habitats associated with sewage disposal that were studied (table 4). The playa used as a sewage lagoon at Abernathy was by far the most important from the standpoint of total mosquito production. The entire flow of effluent from the Abernathy sewage treatment plant was often diverted for irrigation, which prevented the formation of a permanent lake in the playa. This resulted in marshy conditions in the playa which were very favorable for mosquito production.

The oxidation ponds at Petersburg consisted of a series of cells constructed with steep banks. Prolific production of mosquitoes occurred in densely vegetated portions of cells which were only partially filled because of low flows of effluent. In the cells which operated at normal level, mosquito production occurred only along the vegetated banks. The percentage of total water area that produced mosquitoes in the constructed ponds was much lower than for the natural playa at Abernathy. Mosquito production also occurred along the vegetated margins of the sewage polluted streams at Plainview and Tulia.

Table 4. Larval mosquito data collected from habitats associated with municipal sewage disposal, Texas High Plains, April 20–October 29, 1954

Collection data and species composition	Sewage lagoon (playa) Abernathy	Sewage oxidation ponds (constructed) Petersburg	Creek receiving Plainview sewage	Creek receiving Tulia sewage
Number of inspections <sup>1</sup>	17	27	26	27
Total estimated water area inspected (acres)	37.4	71.0	17.1	12.1
Total estimated breeding area inspected (acres)	13.0	1.3	.4	1.9
Average number of fourth-instar larvae and pupae per dip	34.0	62.5	1.7	8.2
Seasonal production index <sup>2</sup>	443.1	81.3	.7	15.6
Percentage by habitat of fourth-instar larvae				
<i>Aedes dorsalis</i>	12	0	0	0
<i>Aedes nigromaculis</i>	17	<1	0	0
<i>Culex quinquefasciatus</i>	35	63	6	33
<i>Culex tarsalis</i>	32	25	91	65
<i>Culiseta inornata</i>	3	1	0	<1
All other species <sup>3</sup>	1	<1	9	1
Total number of specimens identified	4,812	6,251	153	3,110

<sup>1</sup> Larval inspections made weekly when water was present. <sup>2</sup> Production index=(average number fourth-instar larvae and pupae per dip)×(breeding area in acres); seasonal production index=summation of production indexes for entire season. <sup>3</sup> Includes *Aedes sollicitans*, *Anopheles punctipennis*, and *Psorophora signipennis*.

## Encephalitis Virus Isolations

From June 22 to October 26, 4,733 female mosquitoes were collected and subsequently processed for encephalitis virus isolations (table 3). Included were 3,324 *C. quinquefasciatus* in 17 pools, 1,315 *C. tarsalis* in 15 pools, 52 *Anopheles punctipennis* in 6 pools, and 42 *Anopheles pseudopunctipennis* in 2 pools. Western equine encephalitis virus was isolated from 4 pools of mosquitoes: 39 *C. tarsalis* collected in restrooms at the city park in Plainview, Hale County, June 29; 80 *C. quinquefasciatus* collected in shrubbery and concrete pits at the sewage treatment plant, Lubbock, Lubbock County, July 27; 118 *C. tarsalis* collected at the same time and place as the *C. quinquefasciatus*; and 51 *C. tarsalis* collected from restrooms at the city park in Plainview, September 7.

## Mosquito Production on Study Plots

Data obtained from the Plainview study plots are summarized graphically according to type of habitats and source of water in figure 2. According to seasonal production indexes, approximately three-fourths of all mosquito production on the plots occurred in playa lakes

Figure 4. Species composition of mosquito larvae collected from various aquatic habitats, Plainview study area, Texas High Plains, 1954.

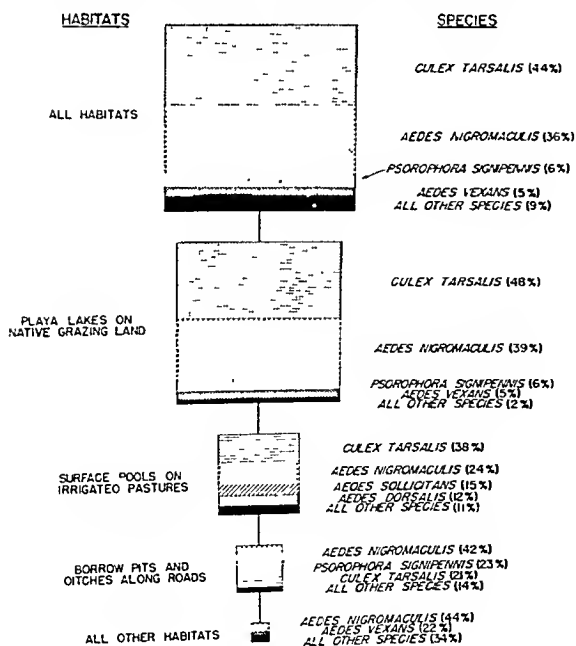
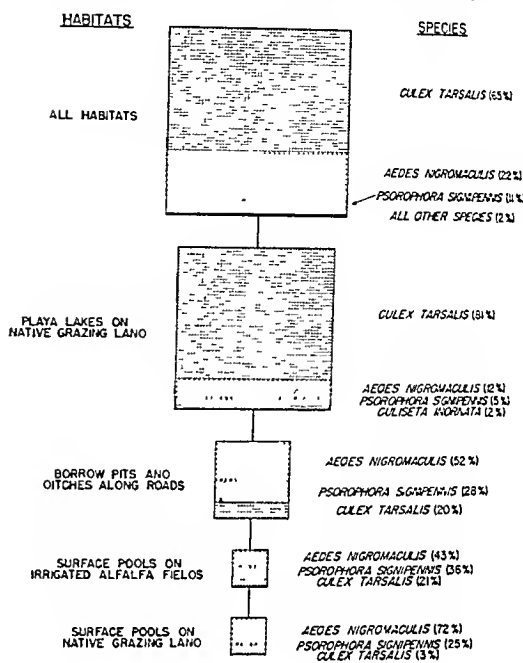


Figure 5. Species composition of mosquito larvae collected from various aquatic habitats, Hereford study area, Texas High Plains, 1954.



on native grazing land. About 20 percent of the mosquito production occurred in surface pools on irrigated pastures; of this production, 95 percent was on the pasture irrigated with sewage effluent. The only other significant breeding places were borrow pits and ditches along roads, which produced 6 percent of the total. Waste and residual irrigation water accounted for 69 percent of all mosquito production on the Plainview plots, residual sewage effluent (on pasture) 18 percent, and surface runoff from local rains 13 percent.

On the Hereford study plot, as in the Plainview area, about three-fourths of the mosquito production during the season occurred in playa lakes on native grazing land (fig. 3). Roadside ditches and borrow pits accounted for 17 percent of the mosquito production. Surface pools on irrigated alfalfa fields and on native grazing land were the only other sources of mosquitoes on the plot, each producing 4 percent of the total.

Surface runoff from local rains was the principal source of water in habitats on the Hereford plot (fig. 3). It accounted for 55 percent of the seasonal production index, as compared

*Surveys in two areas contribute additional evidence that no hazard of cumulative toxic fluorosis is associated with the use of fluoridated water containing 1 p.p.m. fluoride. Within 1 week, the concentration of fluoride in the urine equaled that in the drinking water for adults. For children, the period of adjustment was considerably longer.*

## Urinary Fluoride Levels Associated With Use of Fluoridated Waters

By I. ZIPKIN, Ph.D., R. C. LIKINS, D.D.S.,  
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PREVIOUS studies have demonstrated a close correlation between the concentration of fluoride in the urine and the fluoride occurring naturally in drinking water (1,2). Only a limited quantity of data is available, however, concerning the urinary excretion of fluoride added to a municipal water supply (2-4).

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*The authors are with the Laboratory of Oral and Biological Chemistry, National Institute of Dental Research, National Institutes of Health, Public Health Service. Dr. Zipkin is a biochemist; Dr. Likins is a chemist; Dr. McClure, chief of the laboratory, also is a biochemist; and Mrs. Steere is a biologist.*

*John D. Rust and Frederick A. Bullock, formerly with the laboratory, assisted in collecting the specimens in Montgomery County, Md. Virginia L. DuBois, with the Epidemiology and Biometry Branch of the National Institute of Dental Research, assisted in arrangements for collection of the urine specimens in Grand Rapids, Mich. Dr. Albert L. Russell, chief of that branch, made the statistical analysis of portions of the data.*

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Moreover, it was not determined in any of these studies how soon after beginning the regular ingestion of a fluoride water a stabilized equilibrium is attained, nor was any attempt made to investigate the rate of fluoride excretion in individuals of various ages.

The present study was undertaken, therefore, to provide the following information with respect to fluoridated drinking waters: (a) the relation between the level of fluoride in the drinking water and the concentration of fluoride in the urine, (b) the time required after fluoridation for this relation to become stabilized, and (c) the effect of the age of the individual on the time required for establishment of this equilibrium.

The advent of water fluoridation in Montgomery County, Md., in December 1951 made it possible to obtain such information. Additional, preliminary information was available from Grand Rapids, Mich., where the urinary excretion of fluoride had been under observation since the start of water fluoridation in January 1945. For comparison with the data from these two areas, the results of a survey in 1948 in Aurora, Ill., are presented. The drinking wa-

*C. tarsalis* and *C. quinquefasciatus* were the predominant species in all habitats associated with municipal sewage disposal (table 4). These 2 species comprised 88 percent of over 14,000 larvae collected from the 4 habitats. *A. dorsalis* and *A. nigromaculis* together comprised more than one-fourth of over 4,800 larvae taken from the sewage lagoon at Abernathy.

### Summary and Conclusions

Detailed studies during 1954 in representative areas of the irrigated High Plains in Texas showed that *Culex tarsalis*, the common encephalitis mosquito, was abundant from early June through September. It ranked second in the total number of female mosquitoes taken in light traps and was the most abundant species in larval collections. In biting collections on human hosts at Plainview, *C. tarsalis* ranked second at urban sites and third at rural sites. *Culex quinquefasciatus* was abundant during the latter part of the season in both urban and rural areas. It ranked third in the urban and sixth in the rural light trap collections. Western equine encephalitis virus was isolated from 3 out of 15 pools of *C. tarsalis*, and from 1 out of 17 pools of *C. quinquefasciatus*.

*Aedes nigromaculis* ranked first in the total number of female mosquitoes taken in light traps. It also ranked first in the rural and third in the urban biting collections. *Aedes vexans* ranked fifth in the total number of females taken in the light traps, but it ranked first in the urban and second in the rural biting collections. The abundance and widespread distribution of *C. tarsalis*, *C. quinquefasciatus*, *A. nigromaculis*, and *A. vexans*, and the presence of encephalitis virus constitute a significant public health problem in the Texas High Plains.

Playa lakes on native grazing land accounted for approximately three-fourths of the mosquito production in the study areas. Surface pools and roadside ditches and borrow pits were also important sources of mosquitoes. Waste and residual irrigation water accounted for 87 percent of the total mosquito production at Plainview, and 45 percent at Hereford. Practically all of the remaining production was caused by surface runoff from local rains.

Throughout the High Plains area, much of

the water that collects in the playas is lost through evaporation and transpiration. This loss of water is vitally important to the economy of the region, because the underground reservoir is being lowered by pumpage for irrigation at a much greater rate than it is being replenished. Various methods of making beneficial use of the water that is now lost from the playas have been suggested, and several are being tested at the present time. These and other water conservation measures should be evaluated from agricultural and mosquito control viewpoints. In this area, as in others, such viewpoints are likely to be served by the same methods. Where mosquito production cannot be eliminated by water conservation measures, chemical control will be necessary.

Mosquito production associated with municipal sewage disposal is not as widespread as that caused by irrigation waste water and surface runoff; however, this is a special problem for which both temporary and permanent control measures are needed.

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10 collections, the subjects remained in their particular group relative to age and time of day. Approximately 10 specimens, 1 from each subject, were obtained for each of the 36 age-time groups. Equal volumes from these 10 specimens were pooled to provide the sample for analysis. No consistent variations in fluoride content with the time of the day the specimen was taken were observed; therefore, only mean fluoride values for each age category are given in this report. In the 11th collection, the specimens were obtained without regard for the time of day and were pooled for each age category to furnish four samples for analysis.

In the Grand Rapids survey, spot urine specimens were obtained from male school children aged 6 through 17 years. Approximately 15 spot specimens comprised each pool, and from 1 to 4 pools were analyzed for each age group. Continuous residents furnished the specimens for the last three collection periods. This survey, which was begun before the Montgomery County survey, did not parallel it in all details.

#### Fluoride Concentrations in Urine

The data on urinary fluoride concentrations for the Montgomery County residents are shown in table 2. Prior to fluoridation, the fluoride content of the specimens varied from 0.2 to 0.3 p.p.m. As early as 1 week after fluoridation, it was evident that the children

were responding quite differently from the adults. At the end of 1 week, the adults' specimens contained 0.7 to 0.8 p.p.m. fluoride. At the end of 6 weeks, they contained the expected 1.0 p.p.m. fluoride (10). For these same periods, the fluoride concentration in the urine specimens from the children averaged about half these concentrations, and, although the children varied in age from 5 to 14 years, the fluoride content was essentially uniform for all. As shown by the data for succeeding sampling periods, about 3 years elapsed before the specimens of the children reached 0.9 to 1.1 p.p.m. fluoride.

In table 3, the ratio of urinary fluoride concentration to water fluoride concentration in Montgomery County for each collection period following fluoridation is shown. These ratios illustrate the particularly striking difference between the children and the adults during the first 2 years ( $t=8.82$ ,  $P < 0.01$ ). Equilibrium was reached by the adults after 1 week of fluoridation, whereas approximately 3 years was required for equilibrium to be reached by the children.

The data on urinary excretion of fluoride for the Grand Rapids residents are shown in table 4. The prefluoridation value of approximately 0.2 p.p.m. fluoride in the urine is consistent with the use of the original Grand Rapids water, which contained 0.1-0.2 p.p.m. fluoride. Approximately 2 months after fluoridation was started, the fluoride content of the urine had

Table 2. Fluoride concentration (p.p.m.) in urine specimens, Montgomery County, Md.<sup>1</sup>

Time after fluoridation	Date	Age, in years										
		5	6	7	8	12	13	14	Mean for 5-14	30-34	35-39	Mean for 30-39
0 week	Dec. 15-29, 1951	0.3	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3
1 week	Jan. 3-5, 1952	.3	.3	.5	.4	.2	.3	.4	.3	.8	.7	.8
2 weeks	Jan. 9-11, 1952	.5	.5	.4	.5	.6	.6	.5	.5	.9	.9	.9
4 weeks	Jan. 23-25, 1952	.4	.4	.5	.6	.6	.6	.6	.5	.9	.9	.9
6 weeks	Feb. 7-11, 1952	.5	.5	.6	.6	.5	.5	.6	.5	1.0	1.0	1.0
10 weeks	Mar. 6-13, 1952	.5	.5	.6	.5	.7	.6	.5	.6	1.0	1.0	1.0
20 weeks	May 14-23, 1952	.7	.6	.5	.6	.6	.6	.7	.6	1.0	.8	.9
1 year, 17 weeks	Apr. 23-28, 1953	.8	.8	.8	.8	.8	.8	1.0	.8	1.2	1.2	1.2
1 year, 49 weeks	Dec. 2-4, 1953	.7	.7	.8	.7	.8	.8	.8	.8	1.1	1.1	1.1
2 years, 48 weeks	Nov. 29-30, 1954	1.1	1.0	1.0	1.1	.9	1.0	1.0	1.0	1.2	.9	1.1
3 years, 24 weeks	May 13-20, 1955	.9	.8	.9	.7	.9	1.0	1.0	.9	1.1	.9	1.0

<sup>1</sup> Fluoridation was begun Dec. 28, 1951.

ter in Aurora has contained approximately 1.0 p.p.m. fluoride from natural sources since 1895 (2).

Spot Specimens vs. 24-Hour Samples

The difficulties in obtaining 24-hour urine specimens in a study of this extent are obvious. Accordingly, spot specimens from a number of individuals were pooled in equal volumes to provide a sample for fluoride analysis. Early in the study, information was obtained regarding the relation of the fluoride content of spot specimens to that of the 24-hour total volume.

During a 24-hour collection period, spot specimens were taken between 9 and 12 a. m., 2 and 5 p. m., and 8 and 11 p. m., from 9 adult males who were drinking water containing 1.0 p.p.m. fluoride provided as sodium fluosilicate. These samples, as were all samples in the study, were alkalized with calcium oxide prior to evaporation and ashing and analyzed for fluoride according to standard procedures (5, 6). The results are shown in table 1.

The fluoride concentration in a single spot specimen may vary considerably from that in the 24-hour sample. However, according to the *t* test, the mean concentrations for the 3 spot specimens from the 9 men (0.9 p.p.m., 1.0 p.p.m., and 1.1 p.p.m.) did not vary significantly from the mean fluoride concentration of 0.9 p.p.m. for the 24-hour samples.

Table 1. Fluoride concentration (p.p.m.) in spot and 24-hour urine specimens, Montgomery County, Md.

Subject	Spot specimens			Mean of spot specimens	24-hour specimen <sup>1</sup>
	9-12 a. m.	2-5 p. m.	8-11 p. m.		
A-----	0.3	0.5	0.5	0.4	0.6
B-----	.4	.5	.5	.5	.5
C-----	1.5	1.1	1.3	1.3	1.1
D-----	1.2	1.3	.8	1.1	1.0
E-----	.8	.9	.8	.8	.8
F-----	.6	1.5	2.0	1.4	1.2
G-----	1.5	.8	1.5	1.2	1.2
H-----	.8	.9	.9	.9	.6
I-----	1.1	1.5	1.4	1.3	.9
Mean---	.9	1.0	1.1	1.0	.9

<sup>1</sup> Corrected for spot specimen analysis.

These results apply to exposure to 1.0 p.p.m. fluoride in the drinking water. They agree very well with the data obtained by Largent and Ferneau for other levels of fluoride (7). It appears, therefore, that the fluoride concentration of pooled urine specimens for a group of individuals reflects reasonably well the average fluoride concentration in 24-hour specimens.

Fluoridation of the Drinking Water

Beginning December 28, 1951, the drinking water of Montgomery County, Md., has been fluoridated to approximately 1.0 p.p.m. fluoride by the addition of sodium fluosilicate. The water supplying this area is obtained from the northwest branch of the Anacostia River (8). Water samples taken at widely scattered points in the study area for 10-day periods at the time of the urine collections showed approximately 1.0 p.p.m. fluoride after an initial adjustment period lasting 2 to 4 weeks.

The communal water of Grand Rapids, Mich., which is obtained from Lake Michigan, has been fluoridated for more than 10 years with sodium fluoride. The fluoride content has been maintained at a relatively constant level of 1.0-1.1 p.p.m. (9).

Sampling Procedures

The subjects studied in Montgomery County were male school children and male adults who had had no exposure to a fluoride-containing drinking water before the start of fluoridation and who were in continuous residence thereafter. Nine age categories, as shown in table 2, were represented. At the start of the study, the subjects in each age category were divided into four groups according to the time of day the specimen was obtained. The same subjects were followed throughout the course of the study. For the age category 5-14 years, the 4 collection periods were 8:30 to 10:30 a. m.; 10:30 a. m. to 1 p. m.; 1 to 2 p. m.; and 2 to 3 p. m. For the age categories 30-34 and 35-39, the first 2 collection periods were the same as for the younger age groups, and the second 2 were: 1 to 3 p. m. and 3 to 5 p. m.

Eleven collections of urine were made during a period of about 3½ years. For the first



is clearly shown by the data for the adults in Montgomery County. As early as 1 week after fluoridation, the fluoride concentration of the urine was approximately that of the drinking water.

There is some indication that the period of adjustment was somewhat shorter for the children of Montgomery County than for those of Grand Rapids. The suggested difference in the two areas cannot reasonably be ascribed to a difference in the fluoridating agents, as it has been shown in studies with the white rat that sodium fluoride and sodium fluosilicate have similar metabolic effects (13, 14). It is possible that the variation in sampling procedures was at least partly responsible for the seeming difference. It is also possible that the difference was due partly to the quantity of water ingested. Water consumption, and thus total fluoride ingested, may have been higher in Montgomery County, owing to the consistently higher mean monthly temperature in that area than in Grand Rapids. The temperature difference averages about 10 degrees throughout the year, according to information from the United States Weather Bureau. It is significant that in both Montgomery County and Grand Rapids the children reached the same state of apparently stabilized equilibrium between urinary fluoride concentration and water fluoride concentration as the adults in Montgomery County, even though they required a somewhat longer period of time.

Speculation as to the reasons for the apparently different response of the children and the adults must turn largely to the possibility of basic differences in fluoride metabolism reflected in the skeletal retention of fluoride. The rapid attainment of equilibrium in adults suggests certain limitations in the capacity of mature bone to deposit fluoride. In this connection it may be noted that the mature rat, without prior exposure to fluoride, stored considerably less fluoride in bones and teeth than did the young growing rat, although they ingested equal amounts of fluoride in their drinking water (15). Decreasing amounts of fluoride were stored by rats as the rate of growth diminished, and at maturity a relatively constant level of skeletal fluoride was attained. On the basis of these experimental data, it would seem reason-

able for adults to excrete more fluoride than children and hence reach an apparent equilibrium between the concentration of urinary fluoride and water fluoride at an earlier date. The data of the present study thus lend support to the proposition that the retention of fluoride by bone is influenced by its state of maturity.

The length of time required for the children to reach a relatively constant concentration of urinary fluoride suggests some elevation in the fluoride deposited in the skeletal tissues during this adjustment period. However, this increase in retained fluoride would seem to be very small. The urine during the adjustment period contained 0.5-0.6 p.p.m. fluoride, providing for the elimination of substantial quantities of the waterborne fluoride. It has been shown that no adverse effects on the growth and development of the carpal bones accompany the continuous use of natural fluoride drinking water containing approximately 3.0 p.p.m. or more of fluoride (16). In addition, examinations of children after 10 years of use of a water supply containing 1.2 p.p.m. fluoride added as sodium fluoride failed to reveal anything unusual with respect to the blood, urine, height, or weight; and roentgenographic studies on the hand, wrist, knees, and lumbar spine of these children showed normal development (17). These observations support the conclusion that whatever this increase in the retention of skeletal fluoride by these younger age groups may have been, it was not a health hazard.

### Summary

The concentration of fluoride in the urine was determined in individuals of different ages who were drinking water fluoridated to approximately 1.0 p.p.m. fluoride with sodium fluosilicate (Montgomery County, Md.) or with sodium fluoride (Grand Rapids, Mich.).

In adults (Montgomery County), the water fluoride and urinary fluoride concentrations became approximately equal within 1 week after the introduction of the fluoridated water. In school children aged 5 through 14 years (Montgomery County) and 6 through 17 years (Grand Rapids), a considerably longer period of time (approximately 3 and 5 years respectively) elapsed before the concentration of

**Table 3. Ratio of urinary fluoride to water fluoride, Montgomery County, Md.**

Time after fluoridation	Fluoride in water at tap (p.p.m.)	Urinary fluoride/water fluoride ratio, by age group	
		5-14	30-39
1 week.....	0.7	0.4	1.1
2 weeks.....	.8	.6	1.1
4 weeks.....	1.0	.5	.9
6 weeks.....	.9	.6	1.1
10 weeks.....	1.0	.6	1.0
20 weeks.....	1.0	.6	.9
1 year, 17 weeks.....	1.0	.8	1.2
1 year, 49 weeks.....	1.0	.8	1.1
2 years, 48 weeks.....	1.2	.8	.9
3 years, 24 weeks.....	.9	1.0	1.1

increased to 0.6 p.p.m. Approximately 5 years after the start of fluoridation, some of the school pupils were excreting 1.0 p.p.m. fluoride (ages 6, 7, and 17). In the final three collections in Grand Rapids (1952, 1954, and 1955), the excretion of fluoride averaged 1.0 p.p.m. for all age groups. The ratios of urinary fluoride to water fluoride would be the same as the mean urinary fluoride values, since the fluoride content of the water has been kept at a practically constant level of 1 p.p.m.

The 1948 survey in Aurora, Ill., provides the most recent data for that city. The fluoride content of urine specimens from boys aged 8 through 17 years varied from 0.8 to 1.0 p.p.m. and averaged 0.9 p.p.m. All age groups showed approximately the same fluoride concentrations. It remains speculative as to when these subjects arrived at this apparently stabilized relation

between fluoride in the urine and fluoride occurring naturally in the drinking water. Similar data pertaining to the urinary excretion of fluoride in Aurora residents are presented elsewhere (10).

## Discussion

Efficient elimination of fluoride by urinary excretion has been demonstrated in several clinical and experimental studies (1, 3, 4, 10-12), and is now considered one of the main deterrents to the accumulation of a toxic amount of fluoride in the body tissues. It has been shown also that fluoride is eliminated with equal facility by persons drinking naturally fluoridated water (1, 10-12) and by those drinking artificially fluoridated water (3, 4).

The surveys in Montgomery County and Grand Rapids demonstrated a similar high level of efficiency in the urinary elimination of fluoride added to the drinking water as sodium fluosilicate or sodium fluoride. The findings confirm the results of previous studies, which showed that approximately 1.0 p.p.m. fluoride is found in the urine when fluoride is ingested in drinking water containing 1.0 p.p.m. from natural sources (10) or added as sodium fluoride (3, 4). The findings are regarded as evidence that no hazard of cumulative toxic fluorosis is associated with the use of fluoridated water containing 1.0 p.p.m. fluoride.

An important consideration pertaining to water fluoridation is the time required for a stabilized equilibrium between water fluoride and urinary fluoride to be reached. That the period of adjustment can be remarkably short

**Table 4. Fluoride concentration (p.p.m.) in urine specimens, Grand Rapids, Mich.<sup>1</sup>**

Time after fluoridation	Date	Age, in years														Mean
		6	7	8	9	10	11	12	13	14	15	16	17			
0 weeks.....	Jan. 17-18, 1945.....							0.1	0.1	0.2	0.1	0.2	0.3	0.2		
7 weeks.....	Mar. 6-8, 1945.....	0.6	0.6	0.5	0.7	0.8	0.6	.7	.7	.6	.6	.7	.7	.6		
3 years, 18 weeks.....	May 20-21, 1948.....	.7	.8	.6	.7	.6	.7	.6	.7	.7	.8	.8	.7	.7		
3 years, 43 weeks.....	Nov. 15-17, 1948.....			.7		.8		.8		.8		.7		.8		
4 years, 43 weeks.....	Nov. 15-17, 1949.....	1.0	1.0	.6	.6	.8		.8		.6	.6	.6	1.0	.8		
7 years, 37 weeks.....	Sept. 30-Oct. 7, 1952.....	.8	1.0	.8	.9	.8	1.0	1.3	.9	.9	1.1	.9	1.1	1.0		
9 years, 17 weeks.....	May 13-14, 1954.....	1.0	.8	.8	1.0	1.0	1.0	.8	.7	1.0	1.0	.8	.9	.9		
10 years, 19 weeks.....	May 25-26, 1955.....	.9	.9	.9	.8	1.0	1.0	1.1	1.1	.9	.9	.9	1.0	1.0		

<sup>1</sup> Fluoridation was begun Jan. 25, 1945.

*Last year's outbreaks of salmonellosis in Philadelphia reemphasize the need for vigilant health department supervision of food processing and distribution practices.*

## Smoked Fish as a Vehicle of Salmonellosis

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**D**URING the 1955 Memorial Day weekend, May 28-30, there occurred in Philadelphia three outbreaks of gastroenteritis in which smoked fish was the vehicle for the transmission of *Salmonella* organisms. The events preceding and including the outbreaks have the elements of a classic picture of *Salmonella* food infection.

To those concerned with the public health aspects of food production, distribution, and consumption, it has long been apparent that delicatessen foods are always potential vehicles for bacterial intoxications and infections. The factors supporting this potential are: The foods are generally consumed without further cooking, and some processors and many distributors and consumers disregard their perishable nature.

More than a decade ago, Kleeman, Frant, and Abrahamson (1) reported in detail two outbreaks in New York City of food poison-

ing associated with smoked fish. These events led to changes in the New York City Code with respect to the production and distribution of smoked fish products (2). One of the outbreaks affected 47 persons in 18 families and resulted in 2 deaths. The investigation of the food plant where it occurred revealed the following epidemiological chain, quite similar to that observed in Philadelphia.

Fish in the plant were contaminated with *Salmonella typhimurium*, apparently conveyed by sewage in the washing, soaking, and brining vats.

The process of salting and smoking the fish was not drastic enough to destroy the pathogens.

The lack of refrigeration throughout the entire food distribution system provided almost ideal temperatures for bacterial growth.

### Smoked Fish

The annual processing and consumption of smoked fish in the United States—of kippered salmon, smoked sablefish, smoked whitefish, smoked carp, lox, and similar products—amount to millions of pounds. Even with this volume, the methods of processing have not been touched by technological advances, partly because, perhaps, many of the processing plants are small businesses, family-owned.

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fluoride in the urine reached that in the drinking water.

The difference in the response of adults and children during the initial period of exposure to a fluoridated drinking water suggests that the maturity of human skeletal tissue influences its capacity to retain fluoride.

The results of the study do not suggest any essential difference in urinary elimination of fluoride ingested in naturally fluoridated drinking water and the elimination of fluoride ingested in drinking water fluoridated with either sodium fluoride or sodium fluosilicate.

The findings are regarded as evidence that no hazard of cumulative toxic fluorosis is associated with the use of a drinking water fluoridated to contain 1 p.p.m. fluoride.

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**Table 1. Cases of salmonellosis in the Philadelphia outbreaks, 1955**

Case	Sex	Age	Incubation period (hours)	Dates of positive stool cultures	
				First	Last
W family: Food eaten May 28, 6 p. m.					
1	Male	6	12	July 2	July 2
2	Female	3	12	do	Do.
3	do	29	12	( <sup>1</sup> )	
4	Male	32	( <sup>2</sup> )	( <sup>1</sup> )	
S family: Food eaten May 29, 10 a. m.					
5	Female	2	47	Sept. 9	Sept. 9
6	do	30	( <sup>2</sup> )	June 10	July 14
7	Male	36	( <sup>2</sup> )	do	June 10
8	do	7	( <sup>2</sup> )	June 16	July 14
9 <sup>3</sup>	Female	55	?	do	June 16
Buffet supper: Food eaten May 29, 6 p. m.					
10	Female	37	9	July 1	July 15
11	Male	50	( <sup>2</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
12	do	30	12	June 15	June 15
13	Female	25	( <sup>2</sup> )	do	Do.
14	Male	32	24	June 9	June 9
15	do	5	24	do	Aug. 1
16	do	53	20	( <sup>1</sup> )	
17	Female	49	20	( <sup>2</sup> )	
18	Male	32	24	July 1	July 1
19	Female	26	24	( <sup>1</sup> )	( <sup>1</sup> )
20	Male	58	24	( <sup>1</sup> )	( <sup>1</sup> )
21	Female	46	39	June 14	June 14
22	Male	46	89	June 8	June 8
Carrier: Food source unknown					
23 <sup>5</sup>	Female	30	?	June 10	June 10

<sup>1</sup> No cultures made. <sup>2</sup> No illness. <sup>3</sup> Grandmother who took care of grandchild (case 5) became ill on June 10. <sup>4</sup> No positives. <sup>5</sup> Carrier found at plant A was ill on May 6.

eggs, blintzes, sour cream, noodle pudding, and ginger ale. The smoked fish products were eaten by 13 people. Eleven of them became ill.

The case histories revealed that the incubation periods ranged from 9 hours to 89 hours with a mean of 26 hours.

Case 10 became ill on May 30 at 3 a. m. and had severe abdominal cramps, vomiting, and diarrhea. Case 12 became ill at 6 a. m. and had similar symptoms and chills as well. Case 13, wife of case 12, ate some of the food but was not

ill. Case 11, husband of case 10, also remained asymptomatic after partaking of the food.

Eight persons, cases 14-21, became ill 24 hours after the supper. All 8 had symptoms of severe diarrhea and abdominal pain, and 1, the hostess (case 21), was hospitalized. Case 22 became ill 89 hours after the meal. He had chills, slight fever, and abdominal pain.

A stool culture taken from the hostess on June 14 was positive for *S. newport*. The organism was isolated also from the feces of 6 others and from 1 of the 2 asymptomatic individuals.

### Food Processors and Retail Outlets

The health department started its sanitation investigation after receiving routine notification of the outbreaks in which smoked fish was the apparent vehicle. Calls at the affected households established where the fish products had been bought in each instance.

The kippered salmon eaten by the S family came from the J delicatessen, where sanitary conditions were found to be relatively good. The variety of smoked fish eaten by the W family was purchased at the G delicatessen, which had a refrigerated showcase in need of cleaning. The smoked fish products, however, were not stored in the showcase of the G delicatessen but were kept on top of the counter. The internal temperature of smoked whitefish tested at the store by our sanitarian was found to be 70° F. Presumably, the fish would stay on the counter until sold or otherwise disposed of and would remain at room temperature all the time.

The smoked whitefish eaten at the buffet supper had been purchased at the F delicatessen. There, too, the smoked fish were kept on a counter, fully exposed and unrefrigerated. The internal temperature of a sample smoked fish was 63° F. The fish were kept out all day at room temperature, and at closing time they were placed in a walk-in refrigerator, where the temperature was 36° F. There was some evidence of rodents in the storeroom although general sanitary conditions in the delicatessen were good.

Smoked fish are transported from the processor to the delicatessen in a refrigerated truck

In the past, smoking of foodstuffs was essentially a means of preservation. With modern methods of preservation based on low-temperature storage, there is less need for a heavy smoke. In effect, the light smokes now used are primarily for flavoring the fish.

There are many variations in the smoking process for different types of fish and other food products. One variation applies to the preparation of kippered salmon, one of the products implicated in the Philadelphia outbreaks.

Salmon are usually received in a frozen state and are thawed in tanks or in running water. After thawing, each fish is split and cut into approximately 1-pound pieces, which are then brined from one-half to 2½ hours in a salt solution having 90° to 95° salometer reading. The fish, after being dyed a uniform color with certified dye, are placed on small hooks on wire-bottomed trays. The fish are allowed to drain in the smokehouse racks for several hours and then are heat dried at 80° F. for 8 to 12 hours. To finish off the kippering process, the fire is built up with sawdust and wood chips or shavings to give a hot smoke for about 1 hour at 175° to 180° F. The kippered salmon are cooled by means of circulating air, and then they are wrapped by hand.

There is no question that fish processed in the manner described are perishable products, to be kept under constant refrigeration. The wrappers on the kippered salmon in the Philadelphia outbreaks were clearly printed with a notation that the product was perishable and was to be refrigerated, but we found that these instructions were generally disregarded by the retailers. We found also that whitefish and lox are distributed unwrapped.

### The Philadelphia Outbreaks

The first outbreak of salmonellosis in Philadelphia, designated the W family outbreak, was reported as food poisoning to the communicable disease control section of the City of Philadelphia Department of Health on June 2, 1955. The mother in the family and her two children had symptoms of fever, abdominal pain and diarrhea at 6 a. m., Saturday, May 29. The family had eaten smoked whitefish,

kippered salmon, bagels, and cream cheese at 6 p. m. the evening before, May 28. The father ate the food but did not become ill.

The two children were hospitalized for treatment by their family physician. Stool cultures performed at the hospital were reported as negative for enteric pathogens, but cultures performed at the public health laboratory on July 2 were positive for *Salmonella newport*.

On June 3 a sanitarian from the health department milk and food section visited the W family. Fortunately, some of the fish was still in the refrigerator, uneaten, and he took it to the laboratory for analysis. The finding of large numbers of *Salmonella* organisms in the fish alerted the department to expect reports of other cases of food poisoning since large quantities of smoked fish products are consumed on weekends.

The pertinent facts of the W family cases and of the other 2 Philadelphia outbreaks are given in table 1. The children and mother in the W family are listed here as cases 1, 2, and 3, and the father, who was not ill, as case 4.

The S family outbreak was the next. The mother, father, and 2 children in the family ate smoked whitefish at 10 a. m. on May 29. The 2-year-old child (case 5) became ill 47 hours after the meal and was treated at a local hospital where her illness was diagnosed as salmonellosis.

The other members of the family (cases 6, 7, and 8), although asymptomatic, were found on routine culturing to be excreting *S. newport*. The grandmother (case 9) of the children took care of the sick child, and, although she did not partake of the food, she became ill with fever and diarrhea on June 10. Cultures taken from her on June 16 were found to be positive for *S. newport*.

The third and largest outbreak occurred as the result of a buffet supper, attended by some 30 persons, on May 29 at 6 p. m. Immediate steps were taken June 5 to study the outbreak after an alert practitioner telephoned the department that he was treating four patients who had symptoms of food poisoning.

Most of our information about the supper was obtained at the home where it was served. The foods consumed were smoked whitefish, lox, tunafish, salmon salad, potato salad, hard-boiled

**Table 4. Bacteriological findings in smoked fish from W family outbreak <sup>1</sup>**

Bacteria	Kipperd salmon	Lox	Smoked whitefish
Bacterial count (plate) per gram	$1.3 \times 10^9$	$20 \times 10^8$	$180 \times 10^8$
Staphylococci (coagulase-positive) per gram	$26 \times 10^8$	$6.5 \times 10^8$	$6 \times 10^8$
Enterococci (MPN/gm.)	$11 \times 10^8$	$11 \times 10^8$	$11 \times 10^8$
<i>Salmonella newport</i>	Present	Present	Present

<sup>1</sup> Culture media the same as listed in table 3.

### Source of *Salmonella* Organisms

At the same time plants A and B were being subjected to sanitary inspection, a medical officer from the communicable disease control section of the health department visited both processing plants and arranged to collect fecal samples from all employees. He examined approximately 70 employees and found one, an employee in plant A, to be excreting *S. newport*. Finding of the salmonella carrier was reported by the laboratory on June 13, 11 days after the first cases were reported to the health department.

The carrier (case 23), a woman aged 30, gave a history of illness beginning May 6, 1955, 3 weeks before the outbreaks. She had fever, abdominal pain, and vomiting, and was treated in the outpatient department of a local hospital. The hospital, however, made no effort to take cultures or to diagnose the illness of the patient, who continued to work at the processing plant until she was discovered to be a carrier. In this particular instance, the failure of the hospital to take a culture from a patient with an obvious gastrointestinal complaint had serious consequences.

Upon questioning, the owners of plant A denied that the carrier handled, wrapped, or packed smoked fish, but the carrier, when questioned, stated that she wrapped and packed smoked fish 7 out of 8 hours a day.

### Discussion and Conclusions

Improved bacteriological techniques and more conscientious reporting of cases by hospitals and practitioners than in the recent past

are the main factors behind the apparent increase in outbreaks of salmonellosis in Philadelphia as well as throughout the rest of the country. Salmonellosis was made reportable in Philadelphia in 1944 and in the State of Pennsylvania in 1952. Typhoid and paratyphoid A and B infections have been reportable to the Pennsylvania State Health Department since 1861.

To this day, however, many outbreaks of salmonellosis in family groups are not reported. Because of the long incubation period perhaps, the family gives no thought to the probability that the illness may be due to a food infection. Many persons have been made conscious, and erroneously so, of virus infections. As a result, illness caused by *Salmonella*, which has a short course, may be mistaken for the so-called epidemic nausea, diarrhea, and vomiting of virus origin. Because of failure to perform laboratory studies, many cases of salmonellosis may go undiagnosed even though the sick are treated by physicians. There is no question, however, that practicing physicians have become increasingly aware that gastroenteritis may be due to *Salmonella* infections rather than to other causes.

Epidemiological investigations of food poisoning or food infection outbreaks often are frustrating experiences. Although the elements in the chain of events can be visualized and theorized, it is impossible in many instances to obtain solid laboratory proof to support the theory. Frequently, the suspected food is not available for analysis, or the source of the etiological agent, the carrier, cannot be found.

We were fortunate that the suspect food from one of the outbreaks was available to us and that analysis revealed the causative organism. Thanks to the cooperation of many physicians treating the victims, fecal specimens could be examined. We were able to find a carrier in one of the food-processing plants. The lack of washroom facilities in the plant was conducive to the establishment of the anal-oral route of infection. There was almost complete lack of refrigeration of the fish products in the local retail outlets. Thus, all the elements necessary to close the epidemiological investigation were present.

where the temperature is maintained at about 40° F. One truck from processing plant A served the area containing the three retail outlets investigated. Since the sale of smoked fish products is heavy on weekends, and delivery of the fish usually precedes the weekend, it is quite possible that orders for all three stores came from the same shipment, but we could not ascertain that as a fact.

The processors said that they instruct the delicatessens about the need for refrigerating smoked fish because of its perishability. Nevertheless, many of the delicatessens fail to keep the products under refrigeration, and, since the stores may be open until the early hours of the morning, the fish are likely to remain at room temperature for a long time.

The Processing Plants

Each of the 3 retail outlets was served by the 2 food processors in Philadelphia who prepare smoked fish of the variety considered here. The A plant is located near the dock area on the Delaware River, where the buildings are old and where the original city was founded. Some attempts to improve the old building occupied by the A plant had been made. The floor was in fairly good condition in the room where the fish are thawed, washed, cut, brined, and wrapped. The walls had been recently tiled, and stainless steel tables had been provided for cleaning the fish and for the final wrapping. Housekeeping was poor. Boxes, odd containers, and miscellaneous objects and racks had accumulated on the floor and under tables. The windows were not effectively screened, and a dead mouse was found in the storeroom.

Most germane to the outbreaks was the condition of the toilet rooms and the handwashing facilities. The toilet rooms used by employees in the processing and wrapping operations were remote. The water closets were barely operative. The basin for handwashing was not provided with hot water. The cold water barely flowed. No sanitary towels or soap were available. The entire toilet premises were encrusted with a long-standing accumulation of dirt.

Conditions were generally good in plant B, which is housed in a relatively modern building.

Even there, however, a handwashing basin adjacent to one toilet room did not have flowing water because of inadequate supply lines. When large quantities of water were used elsewhere in the plant, water would not run out of the faucets in the wash basins.

During the first inspection of processing plant A, samples of water from the soaking tanks, samples of brine from the salting tanks, and samples of freshly processed fish ready to be sent to the retail outlets were collected and taken to the laboratory for bacteriological analysis, shown in tables 2 and 3. The results of the analysis of water and brine from the plant are in line with the insanitary conditions there.

Table 2. Bacteriological findings in water and brine from plant A

Bacteria	Water		Brine
	Tank 1 <sup>1</sup>	Tank 2 <sup>2</sup>	
Coliforms (MPN/100 ml.)	9, 300	2, 100	110, 000
<i>Escherichia coli</i> (MPN/100 ml.)	700	400	15, 000
Enterococci (MPN/100 ml.)	930	90	230
Bacterial count (plate) per ml.	14, 000	1, 500	16, 000

<sup>1</sup> Tank used to wash fish. <sup>2</sup> Tank used to soak and store salmon filets.

Table 3. Bacteriological findings in smoked fish from plant A

Bacteria	Kippered salmon	Smoked whitefish
Bacterial count (plate) per gram <sup>1</sup>	900	1, 580, 000
Staphylococci (coagulase-positive) per gram <sup>2</sup>	0	31, 000
Enterococci (MPN/gm.) <sup>3</sup>	0	0
Salmonellae	0	0

<sup>1</sup> Plate count agar (Difco). <sup>2</sup> Salt agar similar to mannitol salt agar (Difco). <sup>3</sup> SF medium (Difco).

It is of interest to compare the bacteriological findings of the fish samples from the A plant with the findings for the fish obtained from the W household, in tables 3 and 4. It is readily apparent, particularly with respect to the kippered salmon, that the bacterial population increased tremendously by the time the fish reached the consumer.



and 4 children were made ill directly by consumption of the food, and 1 adult was made ill through secondary infection. The chain of events leading up to these outbreaks was:

The failure of a hospital clinic to culture a stool specimen from a patient with gastrointestinal symptoms.

The failure of a food processing plant to provide adequate sanitary facilities for its personnel.

The failure of retail outlets to refrigerate a highly perishable food item.

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## Surgeon General Scheele Resigns



Effective August 2, 1956, Dr. Leonard A. Scheele resigned as Surgeon General of the Public Health Service to become president of Warner-Chilcott Laboratories.

Marion B. Folsom, Secretary of Health, Education, and Welfare, commented that Dr. Scheele's "imagination, skill, and resourcefulness" have played "a particularly significant role in the development of many new and expanded programs which have

notably advanced the health of the American people."

Commissioned in the Regular Corps of the Public Health Service in 1934, Dr. Scheele gave 22 productive years to Government service, including 4 years in the armed services. He was appointed director of the National Cancer Institute in 1947 and was appointed Surgeon General in 1948.

## *Salmonella newport*

*S. newport* is the second most prevalent *Salmonella* type found in food infection outbreaks. *S. typhimurium* heads the list. *S. newport* is widely distributed in the United States. In studying 310 cultures of *S. newport* during the period 1934-47, Edwards, Bruner, and Moran (3) found that 220 cultures were isolated from cases of gastroenteritis. A Public Health Service report (4) on food poisoning outbreaks in 1954 indicates that *S. newport* was often implicated in the 1,090 cases representing 22 outbreaks associated with food during that year.

*S. newport* itself would seem to be one of the more potent inciters of gastroenteritis in the *Salmonella* group. The carefully controlled feeding experiments reported by McCullough and Eisele (5) revealed that, of the *Salmonella* types used, *S. bareilly* and *S. newport* could produce illness with small dosage levels. One of the subjects became ill after ingesting 152,000 *S. newport* organisms. Although we do not know the number of organisms introduced to foods by the feces-contaminated hands of carriers, it is readily apparent in our study that the lack of refrigeration in the retail outlets did result in more than enough organisms to produce symptoms of gastroenteritis.

### *Salmonella* Carriers

A convalescent carrier was the source of the etiological agent in the Philadelphia outbreaks. We do not know at this time what percentage, if any, of the others in the outbreaks will become chronic carriers.

The chronic carrier state in humans is rarely observed with salmonellae other than *Salmonella typhi*. Recent experiences indicate that the convalescent carrier state may last longer than was generally assumed. Every person reported as a case in the outbreaks and as having had a positive culture is being considered as a convalescent carrier, and cultures are taken as follows:

The first, second, and third stool cultures are taken at least 5 days apart, beginning after the 14th day of the last dose of any antibiotic or chemotherapeutic agent. If the first 3 cultures are negative, the fourth culture will be taken 1 month after the third culture. If any

of the first 3 cultures are found to be positive, the person will be referred for further treatment. The fifth and sixth cultures will be taken a month apart, and the seventh culture will be taken at the end of the sixth month—again provided that the cultures are negative. If cultures taken from anyone from the fourth month on are positive, then the individual will be considered a chronic carrier of salmonellae and will be placed on a list of chronic carriers.

The results of the followup stool cultures on the cases to date of this report are shown in the last column in table 1. *S. newport* was found in the feces of some of the victims 2 to 3½ months after the outbreaks.

### Lessons To Be Learned

Although the cases we report here are new, the lessons to be learned are old, but they are repeated again for the educational value attributed to repetition. We are aware that even the most rigid food-handler examination program is not perfect in detecting carriers of bacterial enteric pathogens. It is possible for a food handler to become a carrier soon after the annual or semi-annual fecal examination. Thus, in addition to legislation, the importance of educating management and workers in the food industry to the prime requirement of providing and using adequate washroom facilities is paramount.

The failure of retail outlets to refrigerate items that are highly perishable and that are consumed without further cooking cannot be condoned. It is quite apparent that health departments must exercise constant surveillance of local food processors, distributors, and retailers in order to enforce the refrigeration requirements of perishable foods.

The public must be educated to the fact that light smokes and salts used in present day smoked fish processing are not in themselves sufficient for the safe preservation of fish products.

### Summary

We have described three outbreaks in Philadelphia in 1955 of salmonellosis in which smoked fish products served as vehicle for the transmission of *Salmonella newport* from carrier to susceptible consumer. Eleven adults

home, refrigeration, and the health of the family as a whole and its influence on the new baby.

## 2. *The New Baby Comes Home*

With the use of a doll model, the physician and a public health nurse discussed and demonstrated a typical layette. The physician then pointed out the physical characteristics of a newborn and of a 6-week-old baby and discussed the kind of behavior to be expected through the first 6 weeks of life.

## 3. *Baby Gets a Bath*

The physician discussed the skin and its care. The nurse then bathed a 2-month-old baby. In preparation for this program, the nurse bathed the infant several times in his home so that she and the baby would be accustomed to each other.

## 4. *Feeding and Formula Making*

Breast and bottle feeding and the need for vitamin supplements were discussed by the physician. A public health nurse then demonstrated the terminal heating method of formula preparation.

## 5. *Mother's Night Out*

The physician discussed and demonstrated the physical and behavioral characteristics of a 3-month-old child. Then, while the physician spoke of the "introduction of solid foods," the mother demonstrated how to feed a baby with a spoon. The second half of the program dealt with the mother's need for recreation, how to choose a baby sitter, and what the baby sitter should know.

## 6. *Baby Visits His Doctor*

This program opened with the physician telling of the need for regular medical supervision of the well infant. A pediatrician, a mother, and her 4-month-old baby then demonstrated a typical well-baby visit to the doctor. Emphasis was placed on the importance of regular health supervision, immunization, anticipatory guidance, and a permissive atmosphere in which the mother feels free to raise questions and discuss her problems. The mother had been attending the child health conference in which

the pediatrician worked. Therefore, she was quite at ease before the cameras and brought up for discussion traditional beliefs in child care held by older mothers in her subculture. Also, the second diphtheria-pertussis-tetanus inoculation was given on the program.

## 7. *Baby Graduates to the High Chair*

The physician opened the program with a discussion of the physical, motor, and emotional characteristics of the average 6-month-old infant, demonstrating her points with two 6-month-old babies. One child was then placed in a high chair and was offered milk from a glass while the physician talked about weaning, learning to drink from a cup or glass, teething, and thumbsucking. Later, the physician discussed and demonstrated, by offering toys to the babies, safe and suitable toys.

## 8. *Baby Starts to Crawl*

This program began with one 9-month-old baby seated in a playpen while the physician talked about the characteristics of this age group. Fraternal twins were then introduced, and the physician and mother discussed the special problems of a mother with twins. The three babies were permitted to demonstrate their own modes of crawling in free play on the nursery floor, while the physician suggested how the home can be made safe for the creeping baby.

## 9. *Baby's First Step*

Using three 1-year-old babies as models, the physician demonstrated and discussed the physical characteristics and motor abilities of that age group, with special emphasis on normal variations, proper weight-bearing on the feet, and the importance of well-fitted shoes. The children were then permitted to play on the nursery set as the physician talked about the changes in eating habits and other behavior patterns to be expected in the age group.

## 10. *Toddlers*

While the physician talked about growth and development in children between the first and third years, three children, 2-3 years old, were permitted free play on the set. Mothers intervened only to settle altercations over possession

# The Use of a Series of TV Programs to Educate Parents in Child Care

By ANNE B. WAGNER, M.D., M.P.H., and MARY ELLEN PATNO, Ph.D.

SOON after the establishment in Pittsburgh, Pa., of the country's first community sponsored educational television station, WQED, its management requested the Pittsburgh Department of Public Health to cooperate in the presentation of a series of programs on child care. This article describes the content of the series and the results of a survey which was conducted among mothers with young children.

The series was entitled "At Home With Your Child." It included 13 half-hour programs, presented weekly during the first 3 months of 1955. The programs consisted of an exposition of normal physical and emotional growth from birth through the fifth year of life. More fully stated, each program attempted to describe and demonstrate how normal babies and children look and act at each key stage of development, what their needs are, and ways of meeting these needs.

In all but three of the programs, infants and

young children were used on the set to illustrate points of discussion. Children who participated were selected with a view to demonstrating the wide variation in size and motor abilities at each age level. The youngest infants were completely undressed in order to demonstrate physical appearance. Older babies, up to the age of 2 years, were stripped except for diapers. Children beyond 2 years of age were dressed in sunsuits because their emerging sense of modesty might otherwise have provoked unnatural behavior.

None of the subjects displayed uncontrollable crying or other refractory behavior which would have necessitated their removal from the studio. Fears that the lights and cameras might produce apprehension and stilted reactions proved groundless. After a cursory inspection of the studio and cameras, the youngsters devoted themselves to playing with the toys provided, and none of the subjects, from the tiniest, 10 days of age, through the 6-year-olds, paid the least attention to the lights.

The following material outlines the program titles, the various casts, and the material covered. The physician who served as narrator was the only person who appeared on every program.

## 1. *Preparing the Home for the Baby*

The physician and a public health nurse described, and demonstrated where possible, the nursery and its furnishings, heating in the

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*Dr. Wagner is chief of the maternal and child health division and Dr. Patno is chief of the office of biostatistics of the Department of Public Health, Pittsburgh, Pa. Both also are lecturers at the Graduate School of Public Health, University of Pittsburgh.*

*Kinescopes of the programs discussed in the article are available from the National Educational Television Center, Ann Arbor, Mich.*

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home, refrigeration, and the health of the family as a whole and its influence on the new baby.

## 2. *The New Baby Comes Home*

With the use of a doll model, the physician and a public health nurse discussed and demonstrated a typical layette. The physician then pointed out the physical characteristics of a newborn and of a 6-week-old baby and discussed the kind of behavior to be expected through the first 6 weeks of life.

## 3. *Baby Gets a Bath*

The physician discussed the skin and its care. The nurse then bathed a 2-month-old baby. In preparation for this program, the nurse bathed the infant several times in his home so that she and the baby would be accustomed to each other.

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of a toy. Midway in the program the children were seated at a small table and served fruit juice and crackers, while the physician demonstrated and discussed development of handedness and coordination, parallel play, and vocabulary development. The children returned to their play activities and the physician concluded with a discussion of toilet training.

### 11. *Community Help for Families*

The physician interviewed representatives of a public health nursing agency, of a family and children's social service agency, and of the local chapter of the American Red Cross to bring out what services each organization offered and how requests for service are made. Since this program was not considered germane to a growth and development series, it was omitted from a subsequent series.

### 12. *Playmates*

Three children, aged 4-5, were permitted to examine play materials provided on the set while the physician discussed physical and emotional characteristics at this age. A nursery-school teacher then led the children in a demonstration of cooperative play. During the latter part of the program, the physician talked about the control of communicable disease in the preschool child.

### 13. *Getting the Child Ready for School*

This final program opened with the physician pointing out the importance of careful physical evaluation of the child about to enter school.



Using two 6-year-old children as models, the physician demonstrated a vision screening test for a child of this age and the audiologist demonstrated use of the pure-tone audiometer in a screening test for hearing. The audio-engineer put on the air notes of approximately the same frequencies used in the test. The program ended with a discussion by the physician of emotional preparation of the child for school and the value of a preenrollment visit to school.

Since "At Home With Your Child" was the first program of its kind in Pittsburgh, both of its sponsors were interested in assessing the size and reactions of the audience. Both organizations preferred a survey which represented all mothers of preschool children in the Pittsburgh metropolitan area. This was not feasible. It was possible, however, to carry out a mail survey limited to recent mothers in the city of Pittsburgh.

The names and addresses of women who were queried were obtained from a sample of the live-birth certificates for the 12 months preceding the close of the series. The sample was obtained by first selecting all certificates with file numbers ending in the digits 2 or 7. Certificates for extramarital children and those who died in infancy were then excluded and questionnaires were sent by mail to the mothers of the remainder.

Followup of nonrespondents consisted of a reminder which was sent 7 to 10 days after the original questionnaire, described below, and a second questionnaire which was mailed 2 to 3 weeks after the original. Further followup by mail, the only type of followup feasible, was



not attempted for two reasons. First, there was a 70-percent response which was considered sufficient to satisfy purposes of the survey. Second, it was felt that further mail inquiry might result in criticism of the health department or the television station.

The questionnaire asked whether the family owned a television set, whether the mother saw any of the programs, and, if so, which of the programs she found helpful. All other data, such as those concerning race of mother, age of mother, size of family, and place of residence, were obtained from the birth certificate. In this report only the race, age of mother, and size of family are considered. The age groups used are: under 20 years, 20-29 years, and 30 and over. Family sizes have been described according to the number of children, namely: 1 child, 2 or 3 children, 4 or more children.

The sample included 2,476 mothers. Of these, 141 or 5.7 percent could not be reached through the mail. In these cases, the original questionnaire was returned by the post office with the notation that the person was not known at the address or that the person had moved and had left no forwarding address.

As in most surveys of this kind, the relative number of persons not reached through the mail was greater for the nonwhite. While 4.8 percent of the letters to white mothers were returned by the post office, 10.1 percent of the letters to nonwhite mothers were not delivered. The number of questionnaires not delivered also varied with the age of the mother and the size of the family. For example, the proportion of white mothers not reached de-

creased as the age of the mother increased or as the size of the family increased. In other words, within a given age group, the proportion of questionnaires delivered increased as there were more children in the family; and, for given family sizes, the proportion increased as the age of the mother increased. Among the nonwhite mothers, a slightly different pattern was observed. As with white mothers, the number not reached by mail decreased as the age of the mother increased; but, unlike the white, the number of nonwhite mothers who did not receive the questionnaire increased as the size of family increased.

Women who presumably received the questionnaire numbered 2,335. Of these, 1,646 or slightly more than 70 percent responded. White mothers responded better than nonwhite mothers, older mothers better than young mothers, and women with 2 or 3 children better than those with only 1 child or with 4 or more children (table 1). Since only 20 percent of the respondents reported they had watched the series, the response was remarkably high. Three factors may have contributed to the good response. First, the Pittsburgh area has not been subjected to many surveys of this type, and so residents may still be tolerant of mail questionnaires. Second, it is logical that recent mothers would have a strong interest in the subject of child care. And third, pamphlets on child care were offered to respondents.

One of our interests was in determining the size of the potential audience, that is, the number of families who owned television sets. At least 61 percent and possibly as many as 91 per-

Table 1. Response by race, age of mother, and number of children in family

Size of family	White				Nonwhite			
	All ages	Under 20	20 to 29	30 and over	All ages	Under 20	20 to 29	30 and over
<i>All sizes</i>								
Number contacted.....	1, 963	112	1, 172	679	372	44	225	10
Number responded.....	1, 422	60	860	502	224	25	135	6
Percent response.....	72. 4	53. 6	73. 4	73. 9	60. 2	56. 8	60. 0	62.
<i>One child</i>								
Number contacted.....	581	91	421	69	80	28	41	1
Number responded.....	417	50	314	53	46	16	25	3
Percent response.....	71. 8	54. 9	74. 6	76. 8	57. 5	57. 1	61. 0	45. 3
<i>Two or three children</i>								
Number contacted.....	1, 018	21	663	334	159	16	108	35
Number responded.....	755	10	490	255	99	9	65	25
Percent response.....	74. 2	47. 6	73. 9	76. 3	62. 3	56. 2	60. 2	71. 4
<i>Four or more children</i>								
Number contacted.....	364	-----	88	276	133	-----	76	57
Number responded.....	250	-----	56	194	79	-----	45	34
Percent response.....	68. 7	-----	63. 6	70. 3	59. 4	-----	59. 2	59. 7

cent of all families with a child under 1 year of age had sets. The former figure was obtained under the assumption that all nonrespondents were without sets; the latter, under the assumption that all nonrespondents had sets. Among respondents, 86.6 percent, 1,426 of 1,646, owned sets.

There is little doubt that nonwhite families owned proportionately fewer sets than did white families. For example, while 89 percent of the white respondents owned sets, only 69 percent of the nonwhite respondents said that the family had a set. Also, when all persons who did not respond were considered as having television sets, no more than 81 percent of the nonwhite families could have owned sets compared with 92 percent of the white families.

One of the major objectives of the survey was an estimate of the number of women with infants who saw one or more of the programs. Since the sample used in the survey represented one-fifth of the recent mothers in Pittsburgh, such an estimate can be easily obtained by simply multiplying the number of known viewers, 330, by the factor 5 for a result of 1,650. This, however, must be considered a minimal estimate. It is possible that some of the nonrespondents

saw the programs. The largest unknown audience, however, was undoubtedly among mothers in the areas immediately surrounding Pittsburgh, where there are even more births than in the city proper. It is reasonable to assume that the programs were viewed also by others than recent mothers.

The relative size of the audience and whether it varied with such factors as the age of the mother were also of interest. Because some mothers saw the telecasts in homes of relatives or friends even though they did not have television sets and because of the "problems of non-response," the relative size of audience was determined by relating the number of known viewers to the number of persons who presumably received the questionnaire (table 2).

In total, at least 14.1 percent of the mothers watched one or more of the programs. Proportionately, the nonwhite audience was as large as the white audience, in spite of a poorer nonwhite response and evidence that fewer nonwhite families had television sets in their homes. Among white families, as the age of the mother increased or as the size of the family increased, the relative audience size decreased. For example, at least 18.8 percent of the white mothers



under 20 were included in the audience as compared with 12.5 percent of the mothers over 30. The largest audience among the nonwhite mothers consisted of those in their third decade of life.

The initial series of "At Home With Your Child" was produced with very little publicity. A week before the programs began one newspaper carried a feature story in a Sunday supplement. Thereafter an occasional small advertisement was used. In the daily listings of programs, the time period was designated as "Ladies Only" since "At Home With Your Child" was 1 of 5 programs presented at that time of day throughout the week.

The questionnaire included an item which asked the mother if she would have watched had she known of the program. Among 903 women who replied that they had a television set, could receive the educational station, but had not known of the series, 90 percent, 810, said they would have watched had they known of the program. If one accepts their statements at face value and adds the number of known viewers, it means that the audience might have included as many as 49 percent, 1,140 of 2,335, of the recent mothers had the series been widely publicized.

Mothers were asked to specify the number of programs they saw and to indicate which

ones they considered helpful. The 330 women who reported watching the telecasts stated they had seen 1,287 separate programs, an average of 3.9 programs per person. Mothers of only 1 child averaged 3.8 programs; of 2 or 3 children, 4.2 programs; and of 4 or more children, 3.4. Viewers also reported 78.2 percent of the programs seen as being helpful. Mothers with large families found as many programs helpful as did mothers of small families, but their interests were somewhat different. For example, while only 5.5 percent of the mothers with one infant selected "Getting the Child Ready for School" as helpful, 23.0 percent of the mothers with 4 or more children did so. The most popular programs among all mothers were "Baby Gets a Bath" and "Mother's Night Out."

For all family sizes, approximately 84 percent of the respondents requested the pamphlets offered. Mothers who owned television sets requested materials more often than those who did not, 85 percent to 79 percent. Among those with sets, mothers who saw the programs requested pamphlets more often than did those who did not watch, 95 percent to 82 percent. Although this difference suggests that the programs may have stimulated interest in educational materials, there is the possibility that whatever caused the mothers to watch the programs also caused them to request materials.

**Table 2. Number of mothers who watched one or more programs**

Number of children and age of mother	Number contacted			Watched one or more programs					
	Total	White	Non-white	Number			Percent		
				Total	White	Non-white	Total	White	Non-white
All families.....	2, 335	1, 963	372	330	278	52	14. 1	14. 2	14. 0
Mothers under 20.....	156	112	44	26	21	5	16. 7	18. 8	11. 4
20-29.....	1, 397	1, 172	225	208	172	36	14. 9	14. 7	16. 0
30 and over.....	782	679	103	96	85	11	12. 3	12. 5	10. 7
One child.....	661	581	80	109	95	14	16. 5	16. 4	17. 5
Mothers under 20.....	119	91	28	20	17	3	16. 8	18. 7	10. 7
20-29.....	462	421	41	79	70	9	17. 1	16. 6	22. 0
30 and over.....	80	69	11	10	8	2	12. 5	11. 6	18. 2
Two or three children.....	1, 177	1, 018	159	160	134	26	13. 6	13. 2	16. 4
Mothers under 20.....	37	21	16	6	4	2	16. 2	19. 0	12. 5
20-29.....	771	663	108	110	90	20	14. 3	13. 6	18. 5
30 and over.....	369	334	35	44	40	4	11. 9	11. 9	11. 4
Four or more children.....	497	364	133	61	49	12	12. 3	13. 5	9. 0
Mothers 20-29.....	164	88	76	19	12	7	11. 6	13. 6	9. 2
30 and over.....	333	276	57	42	37	5	12. 6	13. 4	8. 8

In other words, they would have asked for the pamphlets without having seen the programs.

## Discussion

Until recent years, education on child care offered by health departments was somewhat limited to that given in child health conference service and in the public health nurse home visit. For obvious reasons, these services are usually restricted to the low-income segment of the population and to families where intensive service is required. Within the last few years, however, it has become evident that many parents at the middle- and higher-income levels, using private physicians as their source of medical care and having some knowledge of child growth and development, welcome further information on child care, especially through mass media. The popularity of child care articles in newspapers and magazines is one indication of this kind of interest.

Television, the newest of the mass media of communication, differs from the others in several important ways. Although it is capable of reaching a large number of people at one time, it is also capable of stimulating an intensely personal reaction, second only to a face-to-face situation. It gives the viewer the illusion of being spoken to directly and hence a feeling of close personal contact. The combination of sound and sight, plus the availability in one's own home, contribute to the viewer's feeling of being part of what is being observed.

In the foregoing study of an audience which watched a series of television programs on child care there are indications that television reaches many families who do not receive medical or nursing care from the health department. The estimated television audience slightly exceeded the number of mothers with young babies who attended child health conferences during this same period. Also, the geographic distribution of viewers differed from that of families utilizing child health conference service. Of the mothers in the known television audience, 84 percent were white; but during the period the

programs were telecast, only 50 percent of the mothers who attended child health conferences and 52 percent of the mothers with infants who were visited by public health nurses were white.

The economy of effort possible through the use of television when the goal is solely education is reflected by the fact that 1 physician and 1 nurse produced this series of programs. In order to provide well-child care for a slightly smaller number of children in the same age group, 499 sessions of child health conference were held during the same period of time, staffed by 1 physician and 2 or more public health nurses for each session.

Inasmuch as both the television station and the health department benefit by having as large an audience as possible, it seems logical that both agencies share in the publicity effort. Before the series was repeated in the fall of 1955, the department and the station combined efforts to publicize it as widely as possible throughout the Pittsburgh area. A feature story was carried by one of the large daily newspapers, in addition to the listing in the television section of each of the metropolitan newspapers. Flyers advertising the program were prepared and distributed to new mothers in the maternity divisions of hospitals, to PTA and other parent groups associated with the schools, to women's club groups, and to customers in infants' wear sections of local department stores. The Carnegie Library prepared an attractive leaflet containing a reading list on child care. The leaflets were placed near a poster advertising the program in all Carnegie branch libraries throughout the area.

When the series was telecast the second time, each program was recorded by kinescope, so that the films would be available not only for periodic daytime telecasting but also for showing at other times and to other groups. It is intended to telecast the films during the evening hours when working mothers and fathers are free to view them. The films are also being offered for use in teaching normal growth and development to medical students and nurses and as background material for parents' discussion groups.

*For reasons as yet unknown, chemical treatment of privies with dieldrin, aldrin, BHC, and chlordane increases the breeding of Musca domestica, according to CDC studies at Savannah, Ga.*

## Fly Production in Treated and Untreated Privies

By JOHN W. KILPATRICK, M.S., and H. F. SCHOOF, Ph.D.

PRIOR to 1951 human excrement was not considered to be an important breeding medium for houseflies. However, since 1951 there has been considerable evidence of copious housefly breeding in human feces. Studies in the lower Rio Grande Valley, Tex. (1), and in Phoenix, Ariz., and Charleston, W. Va. (2), have indicated this intensive breeding to be associated principally with the use of dieldrin as a residual or as a larvicidal treatment in privies.

In 1953 the Technical Development Labora-

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*Mr. Kilpatrick and Dr. Schoof are the co-authors of the article entitled "The Use of Insecticide Treated Cords for Housefly Control," in the February 1956 issue of Public Health Reports (p. 144). Dr. Schoof is chief of the Biology Section of the Technical Development Laboratories, Communicable Disease Center, Public Health Service, Savannah, Ga. Mr. Kilpatrick is an entomologist with the laboratories.*

*Assistance with the studies reported here was given at the laboratories by Dr. Harold R. Dodge, who identified the majority of the species in the lesser known dipterous groups and helped in processing the copious collections of Diptera, and by Fred Freeman and Bernard O. Smith, who helped in preparing the study structures and collecting the fly samples.*

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tories of the Communicable Disease Center, Public Health Service, undertook a long-range investigation in southeastern Georgia, near Savannah, to study this paradox of increased housefly production from treated privies. During 1953 the study of fly emergence from 100 untreated privies (10 in each of 10 areas) substantiated the pre-1951 observations that human excrement as a breeding medium normally contributed little to the overall housefly population (3). In 1954 the study plan was designed to determine what effect chemical treatment of privies with certain chlorinated hydrocarbon insecticides would exert upon housefly and other fly production.

### Procedure

In 1953 the study included the trapping of flies from 10 privies in each of 10 areas (3). In 1954 the same privies were used in studies as follows:

#### *Series I (Dieldrin and DDT)*

(a) Untreated control—20 privies (10 each in 2 areas).

(b) Overall DDT treatment at 200 milligrams per square foot (late March)—10 privies (1 area).

(c) Overall dieldrin treatment at 50 mg./sq. ft. (early April)—30 privies (10 each in 3 areas).

In series Ib and Ic, all animal pens and porches on the premises were treated, as well as the privies. Overall privy treatment included the pits and their contents.

In other words, they would have asked for the pamphlets without having seen the programs.

## Discussion

Until recent years, education on child care offered by health departments was somewhat limited to that given in child health conference service and in the public health nurse home visit. For obvious reasons, these services are usually restricted to the low-income segment of the population and to families where intensive service is required. Within the last few years, however, it has become evident that many parents at the middle- and higher-income levels, using private physicians as their source of medical care and having some knowledge of child growth and development, welcome further information on child care, especially through mass media. The popularity of child care articles in newspapers and magazines is one indication of this kind of interest.

Television, the newest of the mass media of communication, differs from the others in several important ways. Although it is capable of reaching a large number of people at one time, it is also capable of stimulating an intensely personal reaction, second only to a face-to-face situation. It gives the viewer the illusion of being spoken to directly and hence a feeling of close personal contact. The combination of sound and sight, plus the availability in one's own home, contribute to the viewer's feeling of being part of what is being observed.

In the foregoing study of an audience which watched a series of television programs on child care there are indications that television reaches many families who do not receive medical or nursing care from the health department. The estimated television audience slightly exceeded the number of mothers with young babies who attended child health conferences during this same period. Also, the geographic distribution of viewers differed from that of families utilizing child health conference service. Of the mothers in the known television audience, 84 percent were white; but during the period the

programs were telecast, only 50 percent of the mothers who attended child health conferences and 52 percent of the mothers with infants who were visited by public health nurses were white.

The economy of effort possible through the use of television when the goal is solely education is reflected by the fact that 1 physician and 1 nurse produced this series of programs. In order to provide well-child care for a slightly smaller number of children in the same age group, 499 sessions of child health conference were held during the same period of time, staffed by 1 physician and 2 or more public health nurses for each session.

Inasmuch as both the television station and the health department benefit by having as large an audience as possible, it seems logical that both agencies share in the publicity effort. Before the series was repeated in the fall of 1955, the department and the station combined efforts to publicize it as widely as possible throughout the Pittsburgh area. A feature story was carried by one of the large daily newspapers, in addition to the listing in the television section of each of the metropolitan newspapers. Flyers advertising the program were prepared and distributed to new mothers in the maternity divisions of hospitals, to PTA and other parent groups associated with the schools, to women's club groups, and to customers in infants' wear sections of local department stores. The Carnegie Library prepared an attractive leaflet containing a reading list on child care. The leaflets were placed near a poster advertising the program in all Carnegie branch libraries throughout the area.

When the series was telecast the second time, each program was recorded by kinescope, so that the films would be available not only for periodic daytime telecasting but also for showing at other times and to other groups. It is intended to telecast the films during the evening hours when working mothers and fathers are free to view them. The films are also being offered for use in teaching normal growth and development to medical students and nurses and as background material for parents' discussion groups.

greatest amount of light. A cone-type trap, constructed of copper wire (36 x 40 mesh) was then attached over the hole. Sponge rubber affixed to the bottom of the plywood base of the trap assured a tight seal. At the end of each trapping cycle the privies were reopened to allow a resumption of fly breeding. (See photographs.)

In privy studies involving only 3 or 4 privies for each type of treatment, the flies emerging from the privies were trapped for 3 weeks, and then the privies were allowed to remain open for the 3 succeeding weeks. Then another trapping cycle was begun.

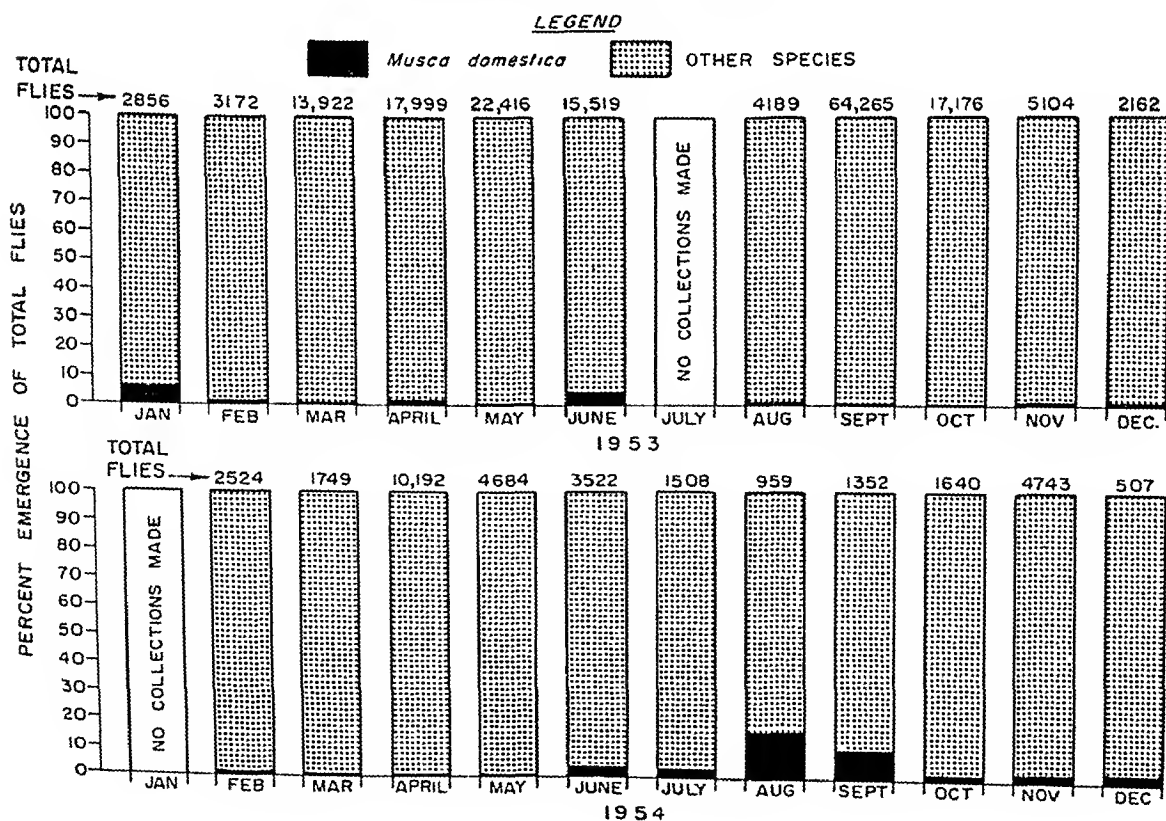
To evaluate the possible effect of dieldrin resistance on housefly breeding potential in treated and untreated privies, one of the untreated areas was located between 2 treated zones (series Ia) approximately one-fourth mile from either zone. As a result, housefly populations from all 3 areas could intermingle

readily. Pretreatment and post-treatment levels of dieldrin resistance in the fly populations of the various areas were measured. These determinations were made by collecting adult flies from the various areas, obtaining eggs from these flies and testing their progeny by 30-minute exposures to plywood panels treated with dieldrin at the rate of 25 mg./sq. ft. Mortality counts were made at 48 hours.

### Untreated Privies (Series Ia)

In the untreated areas (fig. 1), the prevalence of *Musca domestica* was low throughout each entire 12-month period. The largest percentage emergence of *M. domestica* during any one month was 6.3 in 1953 and 16.9 in 1954. Considerable variations occurred from month to month in the total number of flies trapped. This fact can be partly explained by seasonal emergence of various species. *M. domestica*

Figure 1. Percent of *Musca domestica* and other flies emerging from untreated pit privies: 1953 (100 privies) and 1954 (20 privies).





Fly trap in place on privy in Georgia studies.

*Series II (Dieldrin, Chlordane, BHC)*

(a) 3 privies treated with dieldrin at 50 mg./sq. ft. (August).

(b) 3 privies treated with chlordane at 100 mg / sq. ft. (August).

(c) 3 privies treated with BHC (benzene hexachloride) at 40 mg./sq. ft. (August).

(d) 3 untreated control privies.

Treatment was restricted to the privy contents, riser walls (inside and outside), and the inside of the privy superstructure. All privies were within the same 3- to 4-block area.

*Series III (Dieldrin)*

Ten privies treated with dieldrin at 50 mg./sq. ft. (August). Treatment made to inside walls of structure and to pits and their contents.

*Series IV (Dieldrin and Aldrin)*

(a) 3 privies treated (September) with dieldrin at 50 mg./sq. ft. Treatment restricted to the inside of the privy risers. Surfaces not treated were protected from spray drift by paper barriers.

(b) 3 privies treated (September) with dieldrin at 50 mg./sq. ft. Treatment was applied only to the exterior. Adjacent riser surfaces protected from spray drift by paper barriers.

(c) 4 privies treated (September) with aldrin at 50 mg/sq. ft. Treatment applied to the inside walls of the structures and to the pits and their contents.

In evaluating the effects of the dieldrin and DDT treatment (series I) on privy fly production, flies were trapped in 5 privies from each of the 6 areas over a 3-week period. At the end of the 3-week period, flies emerging

from the alternate privies in the same area were trapped. During a trapping period each privy was sealed and made fly tight with the aid of new boards, building paper, masking tape and banked earth around the bottom edges of the building. Each riser was fitted with a seat-hole cover equipped with a spring hinge and lined with foam rubber to provide a close fit when installed over the opening. A hole 6 inches in diameter was cut in the outside wall of the privy approximately 12 inches above ground level on that side of the privy exposed to the

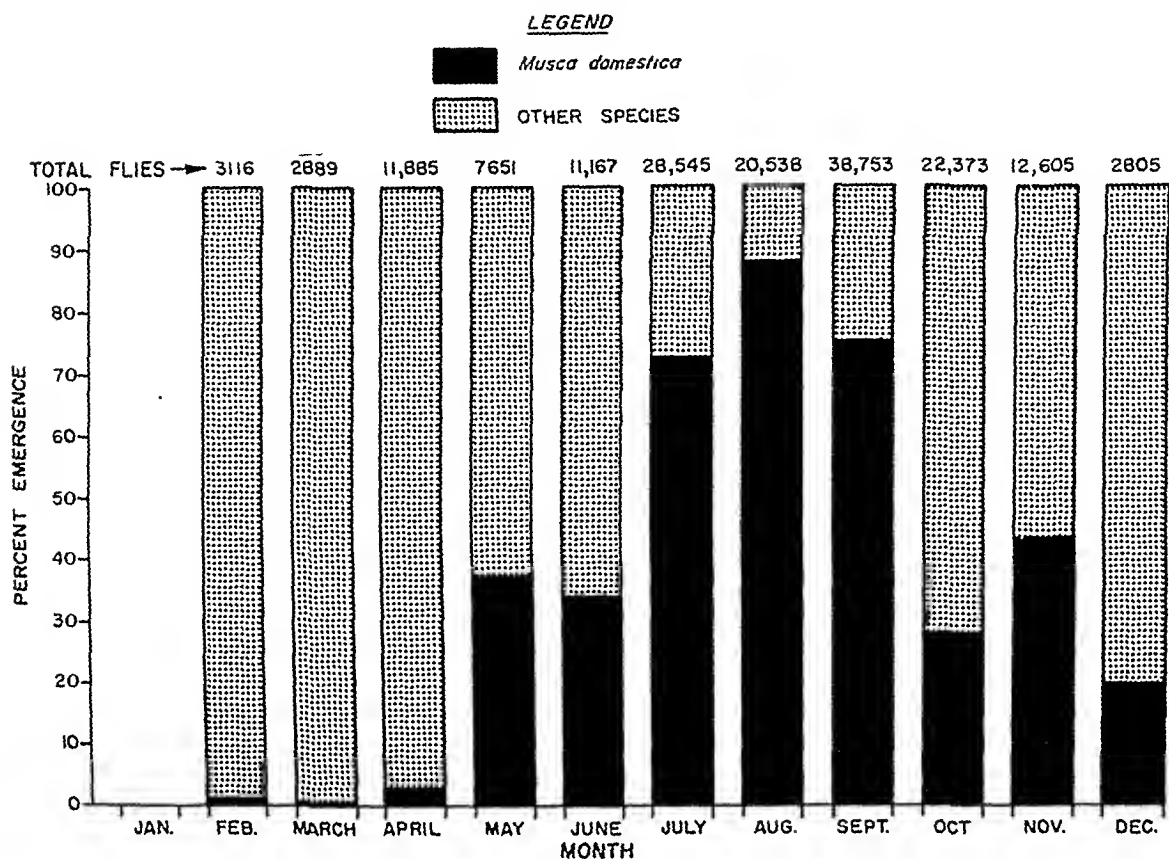


Interior of privy shows seat lid installed.



Closeup of fly trap on exterior of privy.

Figure 3. Percent of *Musca domestica* and other flies emerging from 30 dieldrin-treated privies: 1954.



December despite the fact that during those months housefly activity usually is low. In November, 12,605 flies were trapped, 5,514 of which were houseflies. A majority of the other fly species trapped during this month were either *Desmometopa* spp. or *Leptocera* spp.

#### Series II, III, IV

Emergence data from the privies (series II) treated with dieldrin, chlordane, and BHC are shown in figure 4. Although these data represent emergence from only 3 privies treated with each chemical, they do show that both chlordane and BHC applications can induce increased housefly breeding similar to that obtained with dieldrin residues. Although applied late in August, the treatments resulted in immediate increases in housefly production in September. In contrast, the untreated privies in the same area (3 to 4 blocks) failed to show any aug-

mentation in housefly production. In general, housefly production from the 3 dieldrin-treated privies was considerably higher in magnitude than that from privies treated with BHC and chlordane.

Treatments were applied early in August to the inside and outside walls and pits of 10 privies (series III) in an untreated area. Pre-treatment emergence of *M. domestica* averaged 1 fly per privy. In October the average housefly emergence was 228 per privy and in November, only 11 per privy. Although housefly production from this group of privies was not extremely high, it does show a significant increase, especially in October. The average production of houseflies from untreated privies during that month was only 7 flies.

Data for the 4 privies treated with aldrin and for the 6 privies that received selective treatments of dieldrin (series IV) are shown in figure 5. Housefly emergence from the 10 priv-

was not a major emerging species at any time, representing only 1.2 percent in 1953 and 2.2 percent in 1954. In regard to 1954, the total fly emergence during the month of highest percentage emergence (August) was the lowest in magnitude (959 specimens) during the April to October period. Thus, the pattern of housefly emergence from untreated privies is similar for both years.

**DDT-Treated Privies (Series Ib)**

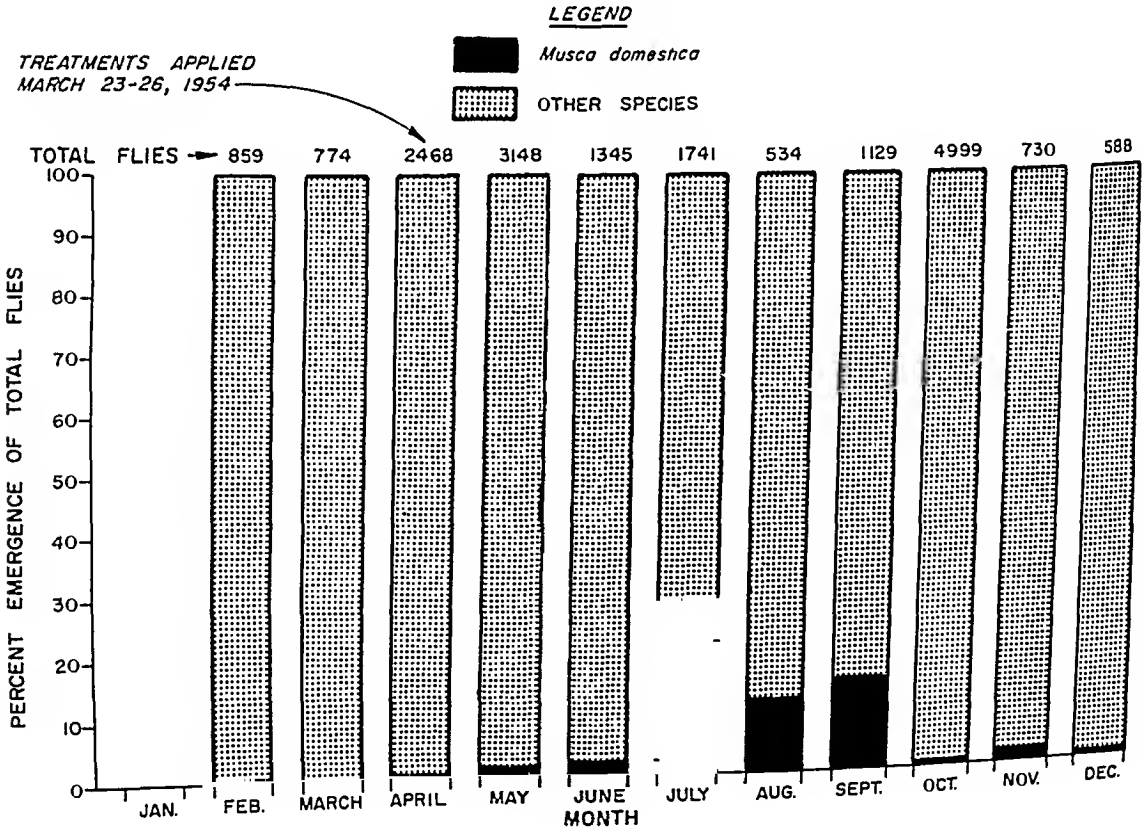
The effect of DDT residual treatments on housefly emergence from privies is shown in figure 2. Although treatment occurred in March, no substantial change in *M. domestica* emergence was noted until July. During that month houseflies represented 29.5 percent of the 1,741 specimens collected. However, of the total of 514 houseflies trapped in the 5 privies during the period, 396 specimens were produced by 1 privy. Subsequent trappings from the

privy failed to show a sustained increase in housefly production so that the apparent increase for a single privy in July appears to be incidental to the general pattern. In general the housefly emergence in the DDT-treated areas was comparable with that from untreated privies.

**Dieldrin-Treated Privies (Series Ic)**

The percentage emergence of *M. domestica* from dieldrin-treated privies is contrasted with other species in figure 3. Although the 3 dieldrin-treated areas received residual applications early in April, increases in the emergence of houseflies were noted in May. Continued increases of housefly production on both percentage and numerical bases also were evident during the ensuing months in all 3 areas. During August, 87.9 percent of the 20,538 flies trapped were *M. domestica*. Increased emergence was apparent for October, November, and

**Figure 2. Percent of *Musca domestica* and other flies emerging from 10 DDT-treated privies: 1954**





*hilariformis* occurred in fewer numbers; however, that was evident both on a pretreatment and post-treatment level. *Telmatoscopus albipunctatus*, although occurring in lesser magnitudes in September and October 1954 than in 1953, was still recorded in considerable numbers in those months (average of 168 per privy in September), and its overall influence on the increased housefly production in dieldrin-treated privies is doubtful.

In general, the changes in prevalences for species other than *M. domestica* were insignificant during the months when the housefly normally is most abundant.

Dieldrin-resistance levels of housefly populations in the treated and untreated areas are shown in figure 6. Pretreatment mortality levels in *M. domestica* from the 3 areas ranged from 53 percent in the untreated zones to 73 percent in the DDT-treated zone. Throughout the entire year mortality levels for houseflies collected in the DDT-treated area were 64 percent or above. In the dieldrin-treated areas housefly resistance increased so that in August 1954 an average mortality of only 1 percent was obtained. Housefly populations in area 5, untreated until September and situated between 2 dieldrin-treated areas, also showed a rapid increase in resistance, a fact presumably explainable by the interchange of flies between the treated and untreated areas. However, the

untreated area, area 6, which was isolated approximately 10 miles from any treated area also manifested an increase in dieldrin resistance that defies a logical explanation.

## Discussion

When the 1954 studies were begun, it was anticipated that several treatments and more than one fly season might be required before changes in the species composition of the fly populations would be apparent. However, within 4 weeks after the dieldrin treatments were applied, housefly indexes manifested an increase. The average emergence level per privy for April was 20 *M. domestica*. In May, it was 193, and in July, 1,374. This rapid rise also was evident in the privies receiving treatments with chlor-dane, aldrin, and BHC in early fall. These findings weakened the hypothesis that the cause underlying the increased housefly production is associated with a change in the physiological or behavioristic pattern of dieldrin-resistant strains. Other data antagonistic to this premise are apparent in the absence of increased housefly production in the untreated areas where the level of dieldrin resistance was high.

Despite the chemical treatments of the privies in 1954, it does not appear that any fly species was eliminated. In 1953, 97 species, 65 genera, and 33 families were recorded in emergence

Table 1. Average emergence per privy of all fly species and of *Musca domestica* from treated and untreated privies: 1953 and 1954

Month	All species				<i>M. domestica</i>			
	Untreated		DDT	Dieldrin	Untreated		DDT	Dieldrin
	1953	1954	1954	1954	1953	1954	1954	1954
February...	142	252	172	208	1	2	1	3
March...	79	175	155	193	3	1	10	1
April...	696	1,019	494	792	21	1	1	20
May...	900	468	630	510	10	3	15	193
June...	388	352	269	741	20	13	7	254
July...	( <sup>2</sup> )	151	348	1,903	( <sup>2</sup> )	5	103	1,374
August...	209	96	107	1,369	3	16	14	1,201
September...	1,607	135	226	2,581	6	10	36	1,946
October...	859	328	1,000	1,492	1	7	7	420
November...	127	949	146	840	4	27	3	368
December...	108	101	118	187	1	3	1	38

<sup>1</sup> Treatments applied.

<sup>2</sup> No collections made.

ies during the pretreatment period from May through September was low. However, immediately after treatment in late September, spectacular increases in housefly emergence were evident, ranging from 56.8 percent to 83.7 percent *M. domestica*. The data indicate that aldrin also induces increased housefly production, and they demonstrate that dieldrin treatment of either the riser walls or pit contents is capable of stimulating the production of *M. domestica*.

A more detailed analysis of the data from treated and untreated privies in 1953 and 1954 is shown in table 1. The average emergence of all species of flies from untreated privies in 1953 and 1954 and from DDT-treated privies in 1954 was generally of about the same magnitude. The increase in average emergence for untreated privies in September of 1953 was influenced greatly by the collection of more than 35,000 *Culex quinquefasciatus* during that period. In contrast the total fly emergence from

Figure 4. Percent of *Musca domestica* and other flies emerging from 3 privies treated with dieldrin, 3 with chlordane, and 3 with BHC: 1954.

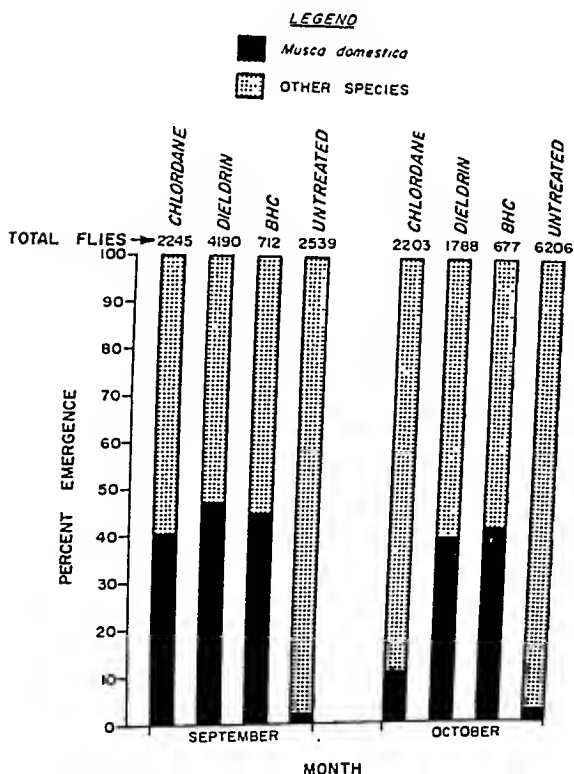
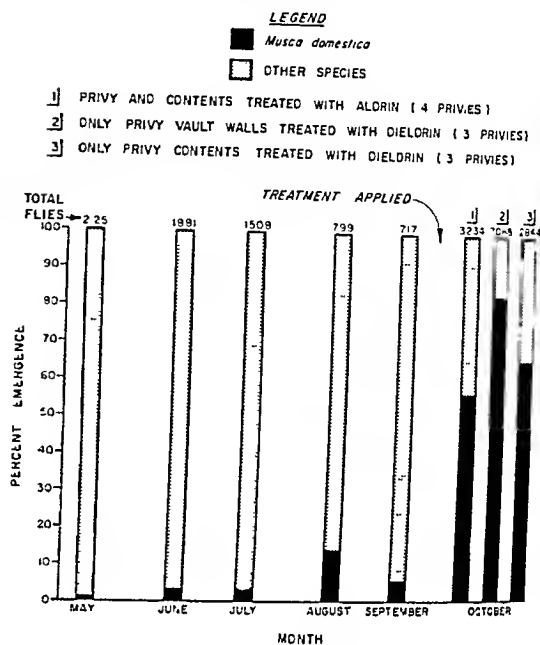


Figure 5. Percent of *Musca domestica* and other species emerging from dieldrin- and aldrin-treated privies: 1954.

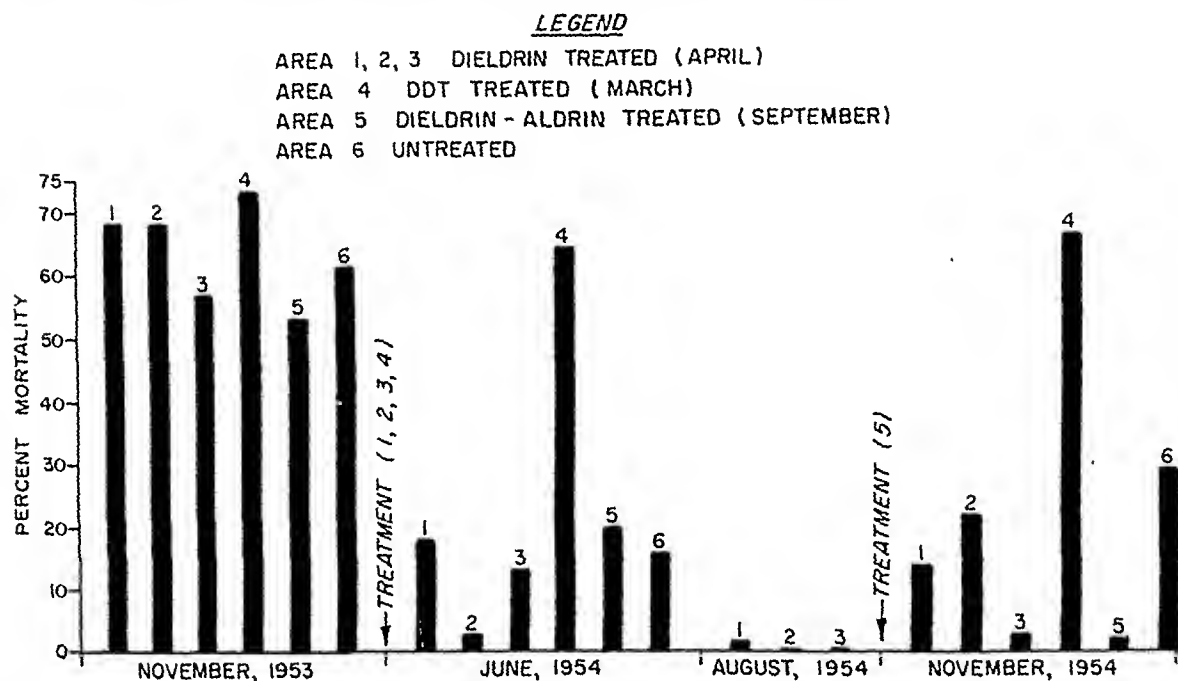


dieldrin-treated privies shows a sharp increase immediately after the treatments were applied. This was particularly evident from July through October.

The average emergence of *M. domestica* alone from treated and untreated privies is also shown in table 1. These data are most significant in that housefly emergence from untreated privies never exceeded an average of 27 flies per privy in either 1953 or 1954, but in September 1954 housefly emergence from dieldrin-treated privies averaged 1,946 flies per privy. As previously stated, the increase in housefly emergence from DDT-treated privies in July 1954 was due primarily to production in one privy. The data for the DDT-treated area in August and succeeding months show that housefly production again reverted to a low level.

A comparative tabulation of the major species which occurred in the untreated privies in 1953 and in the privies treated with dieldrin in the spring of 1954 shows the average fly emergence per privy by months (table 2). Although variations in the magnitude of different species occur, the significance of these fluctuations appears of little consequence with the exception of *M. domestica*. *Dendrophonina*

Figure 6. Dieldrin resistance levels in housefly populations in untreated areas: 1953 and 1954.



the survival of either species. Quantitative evaluation of *H. illucens* as a breeder in privies was not obtained since the 3-week trapping period employed was less than the developmental period of this species.

The 1954 data established several additional points:

1. Increased housefly production can be induced by residual treatments of BHC, aldrin, and chlordane as well as by dieldrin applications.

2. Dieldrin treatment of pit contents alone or of riser walls alone augments housefly production.

3. In the same general area of 3 to 4 blocks, treatment of privies selected at random increased housefly production, but untreated privies showed no augmentation.

None of these points defines the factor or factors responsible for the increase in production of *M. domestica*. The possible exclusion of a competitive agent, parasite, or predator is suggested by the last two points above, but little difference is apparent in the types of arthropods frequenting the treated and untreated privies. Both DDT and dieldrin are known to persist for extended periods, yet the effect of each is

different on housefly production. In contrast, aldrin, which has little residual action, produced results similar to dieldrin.

Despite the absence of any clear-cut explanation for the phenomenon, it is obvious that treatment of privies with certain chemicals increases rather than decreases housefly production from that source. Since *M. domestica* is the principal house-frequenting species, the chance of disease transmission is likewise augmented. Since untreated privies produce few houseflies, it is apparent that chemical treatment of privies should be avoided.

Further studies are now in progress in an attempt to define the factor or factors responsible for the increase in housefly production in privies treated with various chlorinated hydrocarbons.

### Summary

During late March and early April 1954, near Savannah, Ga., 30 privies were treated with dieldrin, 10 privies with DDT, and 20 privies remained untreated. Within 4 weeks the dieldrin-treated privies showed a sharp increase in housefly production. Average monthly indexes per privy were 193, 254, 1,374, 1,204, and

traps. In 1954, 123 species, 76 genera, and 36 families were recorded as coming from both treated and untreated privies. The only flies taken in 1953 and not present in 1954 were of the family Bibionidae, and only token numbers of this group were taken in 1953. Of the specimens collected in 1954, 273,046 flies (38,306 from the untreated areas and 234,740 from the treated areas) were identified; 90,209 were houseflies. Of that number, 88,443 were taken from privies that had been treated with dieldrin, and only 1,766 were taken from

an equal number of either DDT-treated (945 houseflies taken) or untreated (821 houseflies taken) privies. The species captured are listed in the accompanying insert (p. 796).

It was noted that in untreated privies larvae of the soldier fly, *Hermetia illucens*, were extremely prevalent, whereas in dieldrin-treated privies they were either absent or present in small numbers. However, in laboratory cultures seeded with *M. domestica* and *H. illucens* together in varying numbers, there appeared to be little or no detrimental effects upon

Table 2. Average emergence of 8 major fly species from untreated (1953) and dieldrin-treated (1954) privies,<sup>1</sup> by months

Month and year	<i>Musca domestica</i>	<i>Dendrophaoxia scabra</i>	<i>Fannia canicularis</i>	<i>Hydrotaea houghii</i>	<i>Muscina stabulans</i>	<i>Ophyra leucostoma</i>	<i>Psychoda alternata</i>	<i>Telmatoxypus albipunctatus</i>
February:								
1953.....	2	5	32	22	21	5	0	(?)
1954.....	2	57	31	36	6	2	1	(?)
March:								
1953.....	(?) 3	280	33	20	52	77	3	(?)
1954.....	(?)	29	8	49	9	8	2	(?)
April:								
1953.....	4	327	26	25	33	35	14	(?)
1954.....	10	89	13	10	23	41	7	9
May:								
1953.....	8	51	2	(?)	38	150	538	29
1954.....	193	5	2	(?)	14	66	50	8
June:								
1953.....	20	51	(?)	0	1	89	5	84
1954.....	254	4	1	(?)	4	122	19	56
July <sup>2</sup> :								
1954.....	1, 374	2	1	0	2	134	29	201
August:								
1953.....	3	18	0	0	1	15	(?)	75
1954.....	1, 204	(?)	0	(?)	1	16	2	29
September:								
1953.....	7	11	0	(?)	1	3	7	605
1954.....	1, 946	(?)	(?)	(?)	(?)	6	2	168
October:								
1953.....	4	7	1	6	(?)	2	23	623
1954.....	420	(?)	(?)	1	(?)	1	33	149
November:								
1953.....	4	6	2	10	1	4	6	42
1954.....	368	(?)	3	4	(?)	1	29	9
December:								
1953.....	1	21	(?)	27	(?)	1	(?)	7
1954.....	38	1	13	7	(?)	1	6	1

<sup>1</sup> Dieldrin treatments applied in April 1954. No collection made in 1953.

<sup>2</sup> Identified only to Psychodidae. <sup>3</sup> Average is less than 1 fly.

# 1955 Summary of Disease Outbreaks

By CARL C. DAUER, M.D., and GRANVILLE SYLVESTER

ONE OF THE characteristic features in the pattern of disease in man has been a constant change from one predominant type of illness to another. This is true even if one limits his consideration to infectious diseases. Some of the acute infections have receded with respect to incidence and others with respect to severity. Certain diseases, especially viral infections, have appeared to increase in frequency or have become relatively more important because of recession of bacterial infections. These changes may have resulted from alteration in the biology of infecting agents, different host-parasite relationships, the development of immunizing agents, improvement or deterioration in social conditions or in the environment.

The pattern of diseases in which food and water have acted as vehicles of infection has also changed. The number of waterborne outbreaks of typhoid fever and dysentery, and of milkborne outbreaks of enteric infections, diphtheria, and streptococcal infections has been reduced from several score each year to an average of less than 10. Even though reporting is far from complete there is no reason to believe that this is not a real decrease in waterborne and milkborne illness.

As these types of disease have decreased, the number of outbreaks in which foods other than milk and milk products have been vehicles of infection has become proportionately greater

and possibly some types have increased in frequency. It is probable that changes in eating habits have been responsible in part for the relative increase in outbreaks of staphylococcal food poisoning and undifferentiated gastroenteritis. Mass preparation and dispensing of foods in a greater number of public eating places and schools have increased the chances of exposure to contaminated foods. It appears that the solution of human problems has not kept pace with improvements in processing and equipment and provisions for sanitation of equipment. The human problems most frequently mentioned are poor food-handling practices and failure to use adequate refrigeration of foods susceptible to contamination.

## Waterborne Disease Outbreaks

During the last 3 years there has been a continuous reduction in the number of outbreaks attributed to water—from 14 in 1952 to 7 in 1954. In 1955, there were only two outbreaks in which water was definitely incriminated. Although the exact number of cases is unknown, it is by far the smallest in recent years. In 1954, the total, 452 cases, was less than that for previous years. During 1955 one outbreak occurred among fire fighters in the mountains. They had filled their canteens from a water tank previously used to pump cesspools. The number of cases is unknown because none was very ill, and all continued with their duties. The other outbreak was among school children whose water supply was from a well contaminated by a nearby septic tank. Twenty-two cases were reported, and the investigation revealed *Escherichia coli* in the well water. Al-

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*Dr. Dauer is medical adviser to the chief, and Mr. Sylvester is analytical statistician with the Morbidity Analysis Section of the National Office of Vital Statistics, Public Health Service.*

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## Fly Species Collected in Privy Studies

**BORBORIDAE:** *Borborus* spp., *Leptocera* spp., *Leptocera ferruginata*, *L. fontinalis*, *L. vernalis*, *Sphacrocera* spp., *Sphacrocera equinus*, *S. varipes*.

**CALLIPHORIDAE:** *Calliphora livida*, *C. vicina*, *Callitroga macellaria*, *Cynomyia* *cadaverina*, *Phaenicia caculiciviridis*, *P. cuprina*, *P. sericata*, *Phormia regina*.

**CHLOROPIDAE:** *Ceratobarys culophus*, *Hippelates pusio*, *H. bishoppi*, *H. dissidens*, *H. flaviceps*, *Madisa cinerea*, *Monochactoscincella nigricornis*, *Oscinella* spp.

**CHRYOMYIDAE:** *Chryomya flava*, *C. salmarius*.

**CULICIDAE:** *Aedes vexans*, *Anopheles quadrimaculatus*, *A. crucians*, *Culex quinquefasciatus*, *C. erratensis*, *Culiseta melonura*, *Mansonia perturbans*, *Orthopodomyia signifera*.

**DOLICHOPODIDAE.**

**DORILAIIDAE.**

**DROSOPHILIDAE:** *Drosophila busckii*, *D. affinis*, *D. guttifera*, *D. melanogaster* group, *D. repleta*, *D. robusta*, *Drosophila* spp., *Mycodrosophila dimidiata*.

**EMPIDIDAE:** *Drapetis divergens*, *Drapetis* spp.

**EPIHYDRIDAE:** *Discocerthia brunneitensis*, *Discocerthia* spp., *Gymnopa* spp., *Paralimna decipiens*, *Scutella stagnalis*.

**FUNGIVORIDAE.**

**HELEIDAE.**

**HELOMYZIDAE:** *Amoebaleria defessa*, *Diastata ornata*, *Pseudeleria pectinata*, *Tephrochlamys reflexiventris*.

**ITONIIDAE.**

**LAUXANIDAE.**

**MUSCIDAE:** *Atherigona orientalis*, *Cochlosia* spp., *Dendrophana scabra*, *D. querceti*, *Fannia canicularis*, *F. femoralis*, *F. howardi*, *F. manicata*, *F. pusio*, *F. pusio* group, *F. scalaris*, *Fucellia maritima*, *F. americana*, *Graphomya maculata*, *Hebecnema halterata*, *Hydrotaca acuta*, *H. houghii*, *H. occulta*, *Hylemya cili-*

*eruta*, *Limnophora arcuata*, *L. cilifera*, *Musca domestica*, *Muscia assimilis*, *M. aurantiaca*, *M. stabulans*, *Ophyra acnesceus*, *O. leucostoma*, *Schoenomyza* spp., *Scopomyia furcata*, *Stomoxys calcitrans*, *Synthesiomyia nudiseta*.

**OMPHRALIDAE:** *Omphrale fenestralis*.

**OTITIDAE:** *Delphinia picta*, *Euxesta notata*, *Rivellia* spp.

**PHORIDAE.**

**PHYLLOMYZIDAE:** *Desomometopa* spp., *D. nigrita*, *D. tarsalis*, *D. tibialis*, *Leptomctopa latipes*, *Milichiella arcuata*, *M. luteipennis*, *Stomoxys luteola*.

**PIOPHILIDAE:** *Piophilina* spp.

**PSYCHODIDAE:** *Bruceittia nitida*, *Phlebotomus vexator*, *Psychoda alternata*, *P. severini*, *Telmatoctopus albipunctatus*.

**SARCOPHAGIDAE:** *Hypopelma serofa*, *Sarcophaga* spp., *S. bullata*, *S. anandra*, *S. argyrostoma*, *S. assiduea*, *S. derelicta*, *S. floridensis*, *S. galeata*, *S. haemorrhoidalis*, *S. importuna*, *S. laakei*, *S. latisetosa*, *S. morionella*, *S. ochracea*, *S. plinthopyga*, *S. pusiola*, *S. rapax*, *S. sarcacenioides*, *S. singularis*, *S. ventricosa*, *Sarcophagula* spp., *S. impar*, *S. salva*.

**SCATOPSIDAE:** *Scatopse fuscipes*, *S. notata*.

**SCIARIDAE:** *Bradysia* spp., *Sciara* spp.

**SEPSIDAE:** *Meroplus stercorarius*, *Scpsis punctum*.

**STRATIOMYIDAE:** *Hermetia illucens*.

**SYLVICOLIDAE:** *Sylvicola altanatus*, *S. marginatus*.

**SYRPHIDAE:** *Meromacrus acutus*, *Tubifera tenax*, *T. dimidiatus*.

**TENDIPEIDAE.**

**TETHINIDAE:** *Pelomyia coronata*.

**TIPULIDAE:** *Munuctopia occipitalis*.

**TYLIDAE:** *Tachiptera lasciva*.

1,946 specimens for May through September, respectively. In contrast, average monthly indexes for the same period for DDT-treated and untreated privies were 15, 7, 103, 14, and 36, and 3, 13, 5, 16, and 10 specimens, respectively. Nine privies within a 3- to 4-block area, treated in groups of 3 with BHC, dieldrin, or chlordane, also showed increased housefly production with a low prevalence persisting in 3 adjacent untreated privies. Both aldrin-treated privies and dieldrin-treated privies with only the riser walls or the pit contents sprayed likewise produced increased housefly breeding. A total of 273,046 flies, representing 123 species, 76 genera, and 36 families, were trapped in all privies.

The low level of housefly production in un-

treated privies and the increased breeding of this species in privies treated with BHC, chlordane, aldrin, and dieldrin indicate that the use of these chlorinated hydrocarbon insecticides for housefly control in privies should be avoided.

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Table 2. Foodborne, waterborne, and other disease outbreaks by type of infection, reported in 1955

Area	Typhoid fever		Salmonellosis		Shigellosis		Trichinosis		Botulism		Staphylococcal food poisoning		Gastroenteritis		Toxic agents and toxic foods	
	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases
United States.....	5	36	16	971	10	475	5	92	5	14	102	4,130	66	5,160	5	99
New England:																
Maine.....					1	16							2	127		
Massachusetts.....			1	16							4	234				
Middle Atlantic:																
New York.....			2	97	1	30	1	3			5	105	4	228		
New Jersey.....											1	145				
Pennsylvania.....	1	3	1	278					1	2	1	5				
East North Central:																
Ohio.....							1	10			2	251	2	14		
Indiana.....					1	219	1	69			1	14	1	6		
Illinois.....			1	6							3	119	3	58		
West North Central:																
Minnesota.....											2	59	1	121		
Iowa.....							1	6								
Missouri.....											2	103	1	17		
South Dakota.....	1	8														
South Atlantic:																
Delaware.....											1	21				
Maryland.....			1	250							1	105				
Virginia.....											1	12	1	40		
West Virginia.....											2	19	1	85		
Georgia.....											1	9				
Florida.....													1	181		
East South Central:																
Tennessee.....			1	3												
Mississippi.....											1	5				
West South Central:																
Arkansas.....											5	178				
Louisiana.....	1	21									2	44			1	10
Texas.....													2	78		
Mountain:																
Idaho.....											4	17				
Colorado.....									1	5						
New Mexico.....									1	4	3	900	1	88		
Utah.....							1	4					2	150		
Pacific:																
Washington.....											5	31				
Oregon.....					2	16					2	7	1	10		
California.....	2	4	6	51	5	194			2	3	35	510	28	2,478	3	64
Hawaii.....											1	14				
United States 1954.....	16	92	26	1,164	19	1,471	6	53	8	18	100	4,868	103	5,914	10	279
United States 1953.....	12	75	21	533	23	2,230	13	134	7	10	81	4,045	67	4,226	15	606

<sup>1</sup> Includes outbreaks among military personnel, not listed in any State.

were reported, both of which resulted from a carrier. Of the outbreaks from salmonella infections, two were definitely associated with carriers, and it is believed that many more resulted from unknown carriers. In many instances, the source of outbreaks was not determined, but evidence of improper handling and

lack of adequate refrigeration was found to be a contributing factor in most of the outbreaks.

#### Typhoid Fever

The number (5) of typhoid fever outbreaks reported in 1955 was relatively small compared

though not proven, water was a possible vehicle of shigella infection in two children in a summer camp. It was also a possible source of nine cases of infectious hepatitis among school children at a camp.

### Milkborne Disease Outbreaks

The number of outbreaks associated with milk and milk products has not been large (fewer than 10) in each of the last 5 years. In 1955, there were 302 cases in 3 outbreaks compared with 200 cases in 9 outbreaks in 1954. While there were only 6 outbreaks in 1952, the number of cases was about 800. Most of the cases (278) reported during 1955 resulted from 1 outbreak in which commercial milk was the vehicle. An investigation revealed a salmonella organism, group B.

The other 2 outbreaks reported in 1955 resulted from milk products contaminated with *Staphylococcus aureus* during the manufacturing process. In one, 15 cases developed after eating ice cream made in an old freezer which apparently had not been thoroughly cleaned. Contaminated cheddar cheese was associated with nine cases. Since staphylococci were found in the center of cheese from unopened samples, it was concluded that contamination occurred during the manufacturing process.

### Other Foodborne Outbreaks

With only a few outbreaks in which milk and milk products were associated, naturally, a great majority have been from other foods. The total outbreaks associated with other foods reported in 1955 was 193 with 9,633 cases compared with 234 outbreaks and 11,704 cases in 1954. Reports for 1955 were received from 27 States, Hawaii, and military establishments compared with those from 35 jurisdictions in 1954.

As in 1954, foods most frequently incriminated were turkey and chicken (including eggs), custard filled pastries, ham, and beef. However, unlike previous years when potato salad was the vehicle in a number of outbreaks, there were only two associated with this food in 1955. Various other foods were associated with

**Table 1. Foodborne and waterborne disease outbreaks reported in 1955 by vehicle of infection**

Area	Water		Milk and milk products		Other foods	
	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases
United States.....	2	22	3	302	193	9,633
New England:						
Maine.....					2	127
Massachusetts.....					5	250
Middle Atlantic:						
New York.....					12	433
New Jersey.....					1	145
Pennsylvania.....			1	278	2	7
East North Central:						
Ohio.....					5	275
Indiana.....					3	89
Illinois.....	1	22	1	15	5	146
West North Central:						
Minnesota.....					3	180
Iowa.....					1	6
Missouri.....					3	120
South Dakota.....						
South Atlantic:						
Delaware.....					1	21
Maryland.....					2	355
Virginia.....					2	52
West Virginia.....					3	104
Georgia.....			1	9		
Florida.....					1	181
East South Central:						
Tennessee.....						
Mississippi.....					1	5
West South Central:						
Arkansas.....					5	178
Louisiana.....					3	54
Texas.....					2	78
Mountain:						
Idaho.....					4	17
Colorado.....					1	5
New Mexico.....					5	992
Utah.....					3	154
Pacific:						
Washington.....					5	31
Oregon.....					5	41
California.....	1	(?)			71	2,491
Hawaii.....					1	14
United States... 1954	7	452	9	200	234	11,704
United States... 1953	11	719	4	97	194	9,914

<sup>1</sup> Includes outbreaks among military personnel not listed in any State. <sup>2</sup> Not available.

the remainder. In one outbreak the vehicle appeared to have been contaminated by a food handler who had hepatitis. No foodborne hepatitis was reported in 1954.

During the year only two shigella outbreaks



coccal food poisoning. However, the 102 reported in 1955 indicate little change as compared with the 100 for 1954. A number of these outbreaks were confirmed by bacteriological examination, *S. aureus* being isolated in 15 instances. No reports of the isolation of *Staphylococcus albus* were received. In 1954, there were 23 isolations of *S. aureus* and 3 of *S. albus*.

Epidemiological investigation in most instances failed to determine the source, but inadequate refrigeration and improper food handling were usually found. An infected food handler was found in a large number of the outbreaks associated with poor handling procedures. Unsanitary conditions were found to be contributing factors in several outbreaks. About a fourth of the outbreaks were attributed to public eating places and another fourth to private households. A smaller number of outbreaks were associated with bakeries, schools, and field lunches. Hospitals, church gatherings, and picnics were sources of only a few outbreaks.

#### Streptococcal Infections

A total of 353 cases of streptococcal food poisoning was reported in 4 outbreaks. One outbreak was among employees and student nurses in a hospital. About 54 hours after egg salad was served in 2 dining rooms, 116 persons became ill with streptococcal sore throat. A streptococcus was isolated from the salad and from the kitchen helper who prepared it. The helper was ill prior to reporting to work on the day he prepared the egg salad.

Another outbreak involving 181 school children developed 3 days after they had eaten ham in the school cafeteria. Bacteriological examination of the ham revealed *Streptococcus faecalis*. The meat was found to have been improperly handled. One outbreak not associated with food occurred among employees of a restaurant. No secondary cases resulted from this source, indicating none of the food was contaminated by the employees.

#### Chemical and Other Noxious Agents

Five outbreaks involving 99 cases resulted from noxious agents. One was from *Nicotiana glauca* mistaken for polk weed, and the other

four were attributed to chemicals. One involving 50 children resulted from a dye (now prohibited) used to color popcorn. Another was from nicotine sulfate used as a spray on mustard greens. The third was from nitrite in wieners because of faulty processing. Cadmium was incriminated in the fourth and affected 25 persons.

#### Trichinosis

Ninety-two cases of trichinosis were reported in 5 outbreaks during 1955. Of these cases, 69 were in one outbreak among 111 members of two fraternities. Each maintained its own dining room and served "rare" pork to the members, who preferred this type of meat. No large outbreaks occurred in 1954, thus fewer cases were reported that year. However, in 1953, the case total was 134 including an outbreak affecting 73 persons in an institution. Two of the 1955 outbreaks were associated with bakeries, schools, fed hogs. Rats seen on the farms supplying the meat were a possible source of infection of the swine.

#### Gastroenteritis

Numerous outbreaks of gastroenteritis were reported in 1955. Epidemiological investigations of these failed to determine the etiology in all but a few. The majority were believed to have resulted from food; 2 were traced to water, and 1 to a beverage. The method of contamination was not found but improper handling of food was associated with many of the outbreaks. Inadequate refrigeration was a contributing factor in many instances. The accompanying table shows these and miscellaneous outbreaks, such as the 4 of streptococcal food poisonings with 353 cases. Also, included in the table are 2 outbreaks from paracolon organisms which affected 90 persons and 5 outbreaks probably of viral origin. A total of 922 cases was reported in these viral outbreaks.

For 16 outbreaks, although food was suspected to be the vehicle of infection, no specimens were available for bacteriological examination, and no specific item was incriminated. In other outbreaks there was sufficient evidence that a particular food was involved but in many instances none was available for laboratory

with the 16 in 1954, 12 in 1953, and higher numbers in previous years. One outbreak involved 21 cases in 5 related families that had contact with a carrier. Two other outbreaks were traced to carriers, one of whom was a domestic in a private home and may have contaminated food. The source of the other outbreak was not found. It occurred on an Indian reservation where a number of possible modes of spread were found, but sufficient evidence was lacking to incriminate any of these.

### Salmonellosis

Thirteen outbreaks of salmonellosis were reported in seven States during 1955. This is half the number reported in 12 States and 1 Territory for 1954. Three additional outbreaks among military personnel were reported in 1955 compared with none in 1954. The total (971) cases was 17 percent less than the 1,164 cases for last year, but it is about 82 percent greater than the 533 reported in 1953.

All except one outbreak were associated with food. The exception was among persons who attended Pan American games in Mexico, and the source was not determined. In one outbreak at least 278 people supplied by one dairy were affected. Another large outbreak with 250 cases resulted from rice patties served in an institution. *Salmonella montevideo* was isolated from the rice patties, but the source of contamination was not found. In a second institution 6 persons became ill from the ingestion of frozen eggs. *Salmonella pullorum*, commonly associated with eggs, was isolated from the frozen product.

Of the remaining outbreaks, 6 were in private households, 1 in a restaurant, 1 in a club, and 1 in a hospital's newborn nursery. In only 3 of the outbreaks was a carrier found, 1 in the dairy, 1 in the hospital nursery, and 1 in a local store which sold fishcakes to the general public.

Other than those mentioned above, the *Salmonella* organisms isolated were *alachua*, *anatum*, *chester*, *enteriditis*, *newington*, *newport*, *thompson*, and *typhimurium*, and also group B. Three organisms were isolated in connection with one outbreak, and no specific etiology was assigned to it.

### Shigellosis

During 1955 half (5) as many States reported outbreaks of shigellosis as in 1954. This is reflected in the number (10) of outbreaks compared with that (19) for last year. The number of cases (475) is considerably less than the 1,471 reported in 1954, probably because of the distribution of the outbreaks.

In 1955, only 2 outbreaks among children were in institutions, 1 among children in a hospital, and none among school children compared with 17 in these organizations during 1954. The majority of the outbreaks this year were in rural or substandard housing areas. Two cases developed in children in a camp and followed fecal contamination of soil or water, or both.

One outbreak involved 45 persons who attended a wedding reception. An investigation revealed that this was a catered reception, and all food items probably were contaminated by the caterer who was found to be a carrier. One other outbreak resulted from food and the remainder was considered person-to-person transmission.

Six of the outbreaks were from *sonne* types of organisms and 4 were flexner types. Only 3 outbreaks were traced to carriers, the source of the other 7 being unknown.

### Botulism

Five outbreaks of botulism were reported in four States during 1955. Of these, 2 were of type A organisms and 2 were of type B. The other was based on clinical evidence and was not confirmed by laboratory tests. Home canned foods, olives, chili peppers, spinach wild mushrooms, and chayote were incriminated. In one outbreak 5 individuals became ill after eating chili peppers while at work. The person who prepared the food was accused to canning various foods and had canned chili peppers many times before without incident. All five of the victims recovered after receiving botulinus antitoxin. However, of the other 9 cases reported, 7 resulted in death.

### Staphylococcal Food Poisoning

For the last several years increases have been noted in the number of outbreaks of staphylo-

in two outbreaks. One of these outbreaks was in Florida, but cold weather set in and no mosquitoes could be collected for laboratory tests. The other outbreak was in North Carolina where several hundred horses and mules died as a result of the disease. The virus was also found in mosquitoes.

Outbreaks of diarrhea among newborn infants were reported by three States. Thirty-seven infants in six hospital nurseries developed the disease from contact with a carrier or improper sterilization procedures or both. *E. coli* was found in specimens of patients in two outbreaks and other coliform organisms were found in specimens collected in another. No reports of laboratory examination were given for the other outbreaks.

Unusual occurrences of diphtheria were reported, particularly during the latter half of 1955. For the entire year, six outbreaks of the disease were reported. Most of the cases associated with these outbreaks were among people in the lower socioeconomic group. Immunization levels in the affected areas were found to be dangerously low.

Reports of 13 outbreaks of infectious hepatitis were received from five States and Alaska. The mode of spread in most of these was given as personal contact, but some spread probably resulted from fecal contamination. Poor personal habits were given as a possible mode of spread in a few instances.

Food was determined to be the vehicle of infection in 13 cases in one outbreak. Water was suspected in two outbreaks, but there was insufficient evidence to incriminate it. In one, use of unsanitary buckets by members of a football team was considered the source; in the other, polluted water from a stream in a picnic area, used in making a cold beverage, was a possible source.

Five of the outbreaks occurred in hospitals or institutions. Four were among students. The other four were among general populations in localized areas. Although not an outbreak, 201 cases were reported in one city. Of these, 45 were diagnosed as serum hepatitis, or there was a recent history of contaminated needles and instruments.

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tests, or, on testing, no pathogenic organisms were found. The average incubation period was found to be much longer than the 4 to 6 hours usually found in staphylococcal food poisoning. This suggests food infection, some of which may have been salmonella infections. As suspected vehicles, poultry meat was mentioned almost twice as often as any other food, followed by beef, and a few each of creamed filled pastries, fish, and creamed meat or salads.

Five outbreaks probably of viral origin were reported, 2 in schools, 2 in institutions, and 1 in a mountain camp. Viral studies were done in at least two but in none was the etiology definitely established. However, investigations did rule out food and water as vehicles of infection. One large outbreak not listed in the table occurred among the general population in Ohio and was spread by personal contact to approximately 3,000 persons.

#### Animals as Sources of Human Disease

Animals are important factors in diseases of man in several respects. They may be reservoirs of infection which may be transmitted to man by direct or indirect contact. Animal products in the form of food (meat, milk, and eggs) may also be sources or vehicles of infection. Some animal products (hides, hair, and wool) may harbor pathogenic organisms which can infect man.

The importance of animals as sources of infection for man is shown by the fact that 80 different diseases may be transmitted to man. Nearly one-half of the diseases listed for reporting by States to the Public Health Service are in this category. The wide distribution of some of these infections is shown by the following figures: 48 States reported human cases of brucellosis in 1954, 41 reported tularemia, 38 reported Rocky Mountain spotted fever, and 32 reported one or more cases of psittacosis.

Animal food products such as meat, milk, and eggs may not only serve as vehicles of infection from the animal to man but they also are excellent media for the growth of bacterial agents. Poultry meat and eggs are occasionally sources of infection, mostly salmonella infections, or are contaminated during the period of prepara-

tion by organisms causing food intoxication or food infection.

In 1955, there were 30 such outbreaks reported in which about 1,600 cases of illness occurred. Of these, 25 were associated with meat and 5 resulted from eggs. Seven outbreaks, 4 from poultry meat and 3 from eggs, involving 162 cases resulted from salmonella infections. Of those associated with meat, the sources were unknown but epidemiological investigations revealed lack of adequate refrigeration. In one the meat was probably contaminated by a carrier. However, this was not definitely established because three organisms were isolated, none being from the meat itself.

*S. pullorum* was isolated from frozen eggs associated with one outbreak. In another, the organism was not isolated from eggs but there was good evidence that they were contaminated with *S. thompson*. In the third outbreak, there was insufficient evidence of contamination in the eggs although they were eaten by all those affected.

Fourteen outbreaks were from staphylococcal enterotoxin, 1 from streptococcus, and 7 were of unknown etiology. As would be expected in the staphylococcal poisonings, improper food handling was a common finding. Many of those with unknown etiology probably were salmonella infections because the incubation periods were longer than is usually associated with staphylococcal poisoning.

#### Miscellaneous Outbreaks

Three outbreaks of meningitis were reported. One was among preschool and school children in western North Carolina. Another affected two children in a family in Utah. The other occurred among Indians on a reservation and involved eight persons during a 2-week period.

Although two outbreaks of encephalitis occurred among pheasants, no outbreaks of infectious encephalitis were reported in humans during 1955. The prevalence of the disease in California, where it is endemic during the summer months, was markedly lower in 1955 than in 1954. A few laboratory confirmed cases of arthropod-borne infections were received from various parts of the country. Eastern equine encephalitis virus was isolated from pheasants

## Diphtheria Decline Slower in South

Reviewing diphtheria morbidity and mortality data prepared by the Communicable Disease Center of the Public Health Service, Atlanta, Heleu A. Moore, M.D., chief of the Diphtheria Surveillance Unit, and Grace I. Larsen, nurse officer, said that diphtheria, despite its dramatic decline, is still a residual problem in the United States, particularly in the south.

Some 2,000 cases of diphtheria are reported every year in the United States, and the fatality rate remains about 6 to 9 percent, they said. Diphtheria cases still outnumber reported cases of brucellosis, encephalitis, psittacosis, typhoid fever, or, plus, as well as smallpox, malaria, human rabies, or anthrax, and its importance as a public health problem should not be minimized, they added.

Sample findings from the study,

which is being prepared for publication, follow.

Since 1930, diphtheria decreases have been greater in the north than in the south. Seventy percent of the Nation's diphtheria cases between 1950 and 1954 occurred in the South Atlantic, East South Central, and West South Central States.

Moore and Larsen presented maps (see sample) and charts to analyze the incidence.

In the past, both diphtheria case rates and death rates recorded for Negroes have been only a fraction of those recorded for the white population in the southern States. Now, case rates are as high for nonwhite and in some instances are even higher.

Moore and Larsen said: "Intensified immunization programs among Negro children seem indicated."

Diphtheria in the south is still "young diphtheria" despite a proportional increase in incidence among adults in other parts of the country. In Georgia, considered

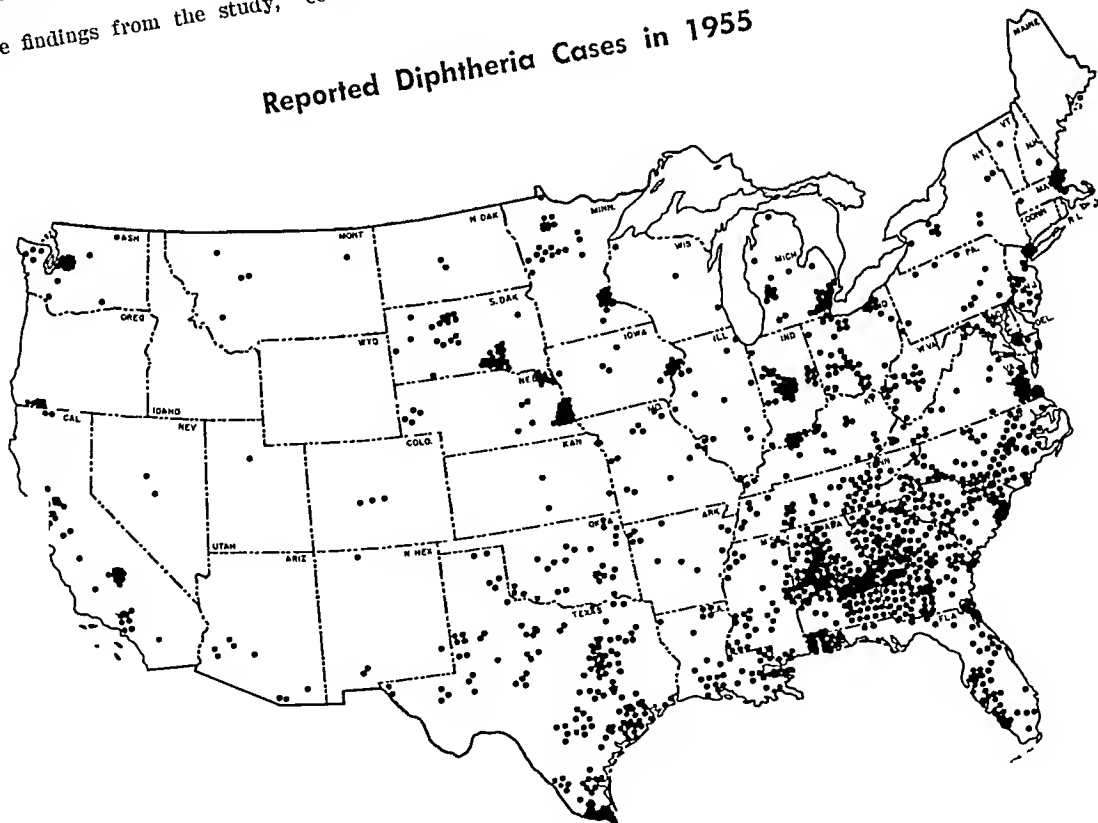
typical, the highest rate was in the age group 1 to 4 years until 1948. Since then the rate for children 5 to 9 years old has been nearly as high or higher.

Moore and Larsen said: "The Georgia experience, which has been paralleled by a similar experience in Kentucky, may hint that a shift in age distribution of cases might occur in the southern area, perhaps not a shift to adults but to older children . . . This would point to a need, not only for very early immunization but for continued immunization throughout school life."

The diphtheria season in the southern States occurs earlier than in other parts of the country. The season can be expected to begin in July or August and to reach a peak in October.

Moore and Larsen said: "This peculiarity of season makes it vital that late summer cases be recognized so that infection may be kept out of schools as far as possible. It is equally vital that children be pro-

### Reported Diphtheria Cases in 1955



# *public health*

## *—community wealth*

### APHA SOUTHERN BRANCH CONFERENCE REPORT

The Southern Branch of the American Public Health Association held its 24th annual meeting April 4-6, 1956, in Tulsa, Okla. Many of the papers read accented the theme of the meeting by demonstrating how some southern communities are benefiting from the advances in public health practice.

News summaries of 12 of the papers are presented here. The encouraging report that local health agencies are adopting a vector control program after successful demonstration projects in several States is the subject of one. In Missouri, another reports, educational activities in farm counties helped bring about enactment of an effective State brucellosis control law. A downward trend in dog rabies is noted in Kentucky, where public opinion brought about a State law for compulsory immunization of the canine population.

Success in a program for the care of the chronically ill was reported from Richmond, Va. In Tulsa, Okla., the health department has an active voice in controlling land improvement, and in Georgia studies show that local mosquito control programs ought to start in late winter.

Other papers discussed demographic changes in the south, a method for determining the costs of administering the poliomyelitis vaccine, psittacosis control, criteria for a local mental health program, and the problem that diphtheria still presents to the southern States.

Attending the meeting were public health workers from Alabama, Arkansas, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

limited to milk ordinance cities in which the local health department requested tests. The bureau was also instrumental in getting tests in the three larger metropolitan areas in the State.

The rate found in the cross-section survey compared favorably with the 37.7 percent rate of infection found in 67,000 dairy herds by the Missouri Department of Agriculture in 1953 in the first statewide ring tests, Price said.

Other phases of the statewide survey were voluntary blood testing at the owner's expense and intensified calfhood vaccination. In a second round of statewide milk ring testing in 1955, the infection rate had dropped to 18.5 percent in 148,177 herd tests. Blood tests of 776,087 cattle during the same period showed 22,141 reactors, or an infection rate of 2.8 percent for brucellosis.

In an epidemiological investigation in 1953-55, the Missouri Division of Health attempted to ascertain the frequency of human brucellosis in a rural area, the probable mode of transmission, and the most prevalent species of *Brucella*.

The study area was confined to 18 counties in district 3 in west central Missouri, a diversified farm area that produces some milk for the Kansas City market. However, most of the dairies are small and produce ungraded milk.

From blood specimens submitted to the bureau of laboratories for routine agglutination studies, all subjects with blood agglutination titers of 1:80 or higher were selected for this epidemiological study.

Of the 62 investigations completed, 35 of the patients were acutely ill and 20 had chronic cases, according to their physicians. (Four did not have brucellosis; 1 veterinarian and 2 veterinary students were not investigated.)

Twenty-eight (80 percent) of the 35 acute illnesses were found in persons having direct contact with infected animals or their discharges, and 7 (20 percent) were attributed to the consumption of infected raw milk or milk products.

Cultures were attempted on all

specimens, and 9 isolations were identified, all of them *Brucella abortus*. Seven of the isolations were from the 28 cases attributed to animal contact (2 of them might have been swine contact), and 2 were from 7 cases of probable milk origin.

The epidemiological findings, Price concluded, compare with those elsewhere in the midwest, with the exception that in this area of Missouri the primary causative agent thus far isolated is *Brucella abortus*.

## Kentucky Reducing Rabies In Dog Population

Public opinion in Kentucky was so aroused after a Louisville boy died in 1953 from the untreated bite of a stray dog that rabies immunization for dogs became compulsory in 1954.

Ronald L. Hcetorne, D.V.M., director, division of veterinary medicine, Kentucky State Department of Health, said that under Kentucky's 2-year-old rabies law the State department of health is responsible for vaccinating all dogs and the State department of agriculture for licensing dogs, collecting strays, and maintaining dog pounds. Local health departments were asked to set up vaccination clinics in cooperation with local veterinarians.

More than 4,000 clinics have been held since the act became effective on July 1, 1954, and more than 200,000 dogs have been vaccinated.

To serve eastern counties, in which there are few accredited veterinarians, a veterinarian has been employed to conduct clinics. In other counties lacking a resident veterinarian, veterinarians from neighboring counties have come in to conduct clinics. In this way, the State with the cooperation of the Kentucky Veterinary Medical Association has overcome a major obstacle in administering the law.

During the 2-year period ending December 31, 1955, 125,652 dogs had received the chick embryo (avianized) vaccine, and 81,193 the brain tissue vaccine. The chick embryo vaccine is used at all local clinics sponsored by the health department.

Dogs vaccinated in the clinics wear a standard tag containing the vaccine manufacturer's name, the serial number of vaccination, and the year of vaccination. The color of the tags is changed each year.

The success of the program is shown in the downward trend of rabies in the dog population. Laboratory-confirmed rabies has been reduced from an average of 398 positive cases during the 5 years before 1954 to 261 in 1954 and 120 in 1955. Rabies infection verified in dog heads submitted for examination has fallen from 44 percent in 1953 to 30 percent in 1955.

Rabies in wildlife, however, is on the increase in the State, Hcetorne reported. The State health department and the Kentucky State Fish and Wildlife Department are trying to reduce the fox population.

## Florida Sets Tentative Cost For Administering Vaccine

Preliminary calculations indicate that 64 cents is the cost of administering a single injection of poliomyelitis vaccine in Florida. Since 90 percent of all poliomyelitis vaccine distributed by the Florida State Health Department goes to county health departments, a time-cost study was run in 5 selected counties to estimate administration costs for the entire State.

Representing the county health department in Orange County, Wade N. Stephens, M.D., M.P.H., Orlando, explained how the estimated figure was derived. Time-cost records were kept in health departments in Franklin, Gulf, Leon, Orange, and Wakulla Counties for 7½ months, ending February 29, 1956.

The per dose cost of administration to the local health department is found by dividing local cost by number of doses given (table). The sum of individual employee costs plus cost of supplies, excluding vaccine, equals the monthly cost of the poliomyelitis program to each health department.

To obtain individual employee costs, multiply the total hours worked each month by an employee

tected by immunization before entering school. Ideally, of course, they should be immunized during infancy with only a recall immunization needed before school entry."

## Setting Up Rabies Control In the Health Department

If canine rabies is to be prevented, restraint of the dog population, operation of the pound, and the anti-rabies vaccination program should all be centralized within the communicable disease program of the local health department, asserted Luther E. Fredrickson, D.V.M., M.P.H., public health veterinarian, Tennessee Department of Public Health.

"A most important element in public education is a well-managed pound, kept odor-free, with a system of accurate records," he added.

Fredrickson had concrete suggestions for organizing efficient dog control:

1. Legislation should provide that the dog shelter and the rabies control officers be under the supervision of the health officer; that all personnel have civil service protection; that owners be required to secure vaccination of their dogs; that a public health veterinarian direct the program. The ordinance should be supplemented with regulations.

2. Dog wardens and control officers must be skilled in meeting the public in addition to being adept at handling dogs.

3. A thorough record system, set up by an experienced auditor, is fundamental. It must incorporate a method of accounting, recording of cash, and auditing.

Forms for investigation of complaints on straying dogs should be filed for future reference after a complaint is closed. A daily summary should describe each dog received. A signed statement from the owner or harbinger of the dog involved in a biting incident will clear the dog surrendered for destruction or adoption.

Tags will facilitate identification of lost dogs. Owners should be notified. Proper forms for recording the location and condition of biting dogs

during the period of quarantine are necessary to physicians treating victims of dog bites.

4. Equipment should be designed to provide for easy cleaning, protection of personnel, and proper care of the dog.

A thorough daily cleaning schedule will keep the pound and vehicles free from obnoxious odors.

Equipment for the pound should include various types of brushes, facilities for the hot detergent as well as a sanitizing agent, and a well-designed sewer system. Water taps, hot and cold, should be at convenient locations.

The examination room should be equipped with tables for vaccinations, examinations, and autopsies, with refrigeration for vaccine and the preservation of dog carcasses pending laboratory examination, and with hot and cold running water.

Ventilation of collection vehicles should be designed so that children are not able to reach through the openings to pet a dog. The vehicle bed should provide drainage. Metal is the most suitable material for the truck compartments.

Secure, individual compartments for rabies suspects are necessary both in the truck and at the pound. A separate section of the shelter should be reserved for cages of rabies suspects.

5. The areas of the community in which rabies control officers can best prevent new cases of animal rabies can be determined by epidemiological studies.

Areas that have yielded rabid animals should be intensively patrolled. Strenuous efforts must be made to locate animals and persons bitten by a rabid dog. Exposed animals should be destroyed immediately, or, at the minimum, quarantined for 6 months.

Areas with low percentages of vaccinated dogs should be given particular attention. Sections where less than 80 percent of the dog population is protected by current vaccination are likely sources of rabies outbreaks.

6. The public ought to visit the pound, except where rabies suspects are quartered. Visitors can learn from employees how the community

is protected against rabies. The dog shelter may be included in the field trips planned for school children.

## Missouri Gains Legislation For Brucellosis Control

Missouri's activities in brucellosis control, culminating in an effective State law in August 1955, were reported by Edmund R. Price, D.V.M., public health veterinarian and assistant director of the bureau of communicable diseases, Missouri Division of Health.

The high prevalence rate of brucellosis was indicated in a 1951 Federal report, stating that 6.7 percent of the cattle in the State were positive to the blood agglutination test.

The Missouri Division of Health had urged adequate legislation for years, but its efforts were accelerated in the past 5 years, Price indicated. The division conferred frequently with leaders of the several brucellosis committees that had been appointed since 1940 to advise on legislation. Projects included an education campaign, a milk ring test survey, and an epidemiological investigation of human brucellosis cases.

In 1951, four copies of the film "The Triple Threat of Brucellosis" were made available to all the schools, PTA's, and farm and civic organizations through the division's bureau of health education. Several hundred thousand persons, in urban as well as rural areas, saw this film. In many counties, health personnel used the film as a primary part of their school health education program. In other counties, the local health departments held area symposiums on brucellosis. Many radio scripts and newspaper releases were prepared for local use. Thousands of pieces of literature were sent out by the bureau of health education, and all of the State health agency's envelopes carried the postmark "Stamp Out Brucellosis."

The milk ring tests, conducted in 1952 by the division's bureau of laboratories, yielded a brucellosis infection rate of 38.2 percent in 708 herds supplying 6 cities. The survey was



pneumonias and ill-defined fevers, he asserted.

Interstate shipments of parakeets are so large and numerous that North Carolina's present program of investigating bird populations suspected as the sources of human psittacosis infections and destroying aviaries where infection is found seems grossly inadequate, he declared.

## Vector Control Projects Found Successful

The key to the encouraging success of the community vector control demonstration program has been its acceptance by the public, according to Charles E. Gerhardt, M.S., vector control consultant to the Communicable Disease Center of the Public Health Service.

Local health agencies have adopted permanent programs of environmental sanitation for vector control on a par with such programs as food, milk, and water sanitation, he asserted.

Demonstration projects at Pueblo, Colo., and Kansas City, Kans., have been completed. Projects at Laredo, Tex., Boise, Idaho, Cedar Rapids, Iowa, and Gadsden, Ala., are current, he reported.

In one area, Gerhardt said, 500 cesspools were replaced with proper facilities; in another area, 1,800 outdoor privies were razed. Miles of sewer extensions have been laid, and several million dollars worth of bonds have been approved for future extensions.

At all projects, garbage and refuse storage, handling, and disposal practices have been notably improved, and, he added, the improved practices have been adopted by a number of nearby cities. In several communities the application of the recommended garbage and refuse handling methods resulted not only in an improved environment for the control of communicable diseases but in savings of more than the cost of the demonstration program. Also, he said, some property and land values increased, and some previously unusable land was reclaimed.

Industry has been cooperative, Gerhardt commented, in correcting major problems of industrial wastes disposal, and the keepplug of large animals in cities has been eliminated or controlled through enforcement of legislation.

## Participation in Projects

A city or county is selected for a demonstration project on the basis of vectorborne or related disease problems, location in relation to other cities, need for general improvement in environmental sanitation, the attitude of local government officials and citizens to change, and ability to finance the program. Direct requests from State and local health authorities also have a bearing on the decisions, Gerhardt said.

Federal participation consists primarily of providing a technical supervisor, assigning vehicles, and supplying spraying equipment, training, and educational aids. The technical supervisor is assigned to the local health agency for a period of 2 years. He conducts the program according to State and local health department policy.

Of primary importance is the assignment by the local health agency of a qualified person to assist the technical supervisor with surveys, evaluation, project details, and who will take over direction of the program when the technical supervisor leaves, Gerhardt asserted. The local health agency also provides office and shop space, manpower, chemicals, enactment and enforcement of necessary legislation, and obtains interdepartmental cooperation.

Endorsement of the project by the State is a primary requisite, he said. State participation in the project varies according to State policies. Some States supply travel funds for observers from other cities.

## Development Procedures

Gerhardt mentioned procedures in the development of a typical community vector control demonstration project, including a community-wide survey to evaluate and delineate insect vector problems; legislative needs; garbage, refuse, and industrial waste handling and dis-

posal standards; animal maintenance; extension of sewerage systems; insect and rodent control; and educational activities.

Education is vital to the success of the program and is used in a "do-it-yourself" context. The community thus develops its own skills, abilities, and interest. Such interest is the best assurance that the program will be actively continued and supported after Federal participation is withdrawn, Gerhardt said.

## Mental Health Action Criteria Outlined

The director of a local mental health program must deal with the interrelationships of all individuals in the community. His decisions affect the behavior of the public and bring about action to destroy adverse predisposing influences and to nurture favorable ones, said Guy V. Rice, M.D., director of health conservation services, Georgia Department of Public Health.

All action promoted by the health officer in developing a community mental health program, Rice said, occurs in the following places: the home (including the hospital), the church, the school, the "factory," and the playground. It will pertain to one or more of the following factors: understanding and acceptance, replacement and substitution, anticipatory guidance, "built-in reactor," and support.

## Specific Programs

Rice listed eight specific programs which he said can bring about improvement of a community's mental health:

General education to bring about understanding of mental illness and to dispel fear and stigma.

Attack on maternal deprivation through relocation of children with their mothers or arrangement for care by a permanent mother substitute.

Preparation for physiological or other crises, such as childbirth, caring for an infant, adolescence, and old age, by providing educational material or holding special classes.

## Cost of giving vaccine in 5 Florida counties

County	Total local cost <sup>1</sup>	Doses administered	Cost per dose
Orange.....	\$4,165 88	6,367	\$0 65
Leon.....	2,687 46	8,093	33
Gulf.....	1,149 64	1,033	1 11
Franklin.....	582 21	223	2 61
Wakulla.....	772 46	493	1 57
Total ....	\$9,357 65	16,209	\$0 58

<sup>1</sup> August 12, 1955, to February 29, 1956

by his hourly wage, calculated on the basis of a 40 hour week. To this amount, add the number of miles he travels, multiplied by 7½ cents.

To obtain an approximation of the total local cost throughout Florida, multiply the average cost per dose in the five counties by the total number of doses given throughout the State: \$0 58 (average cost per dose, from table) × 228,264 (total doses given in State) = \$132,393 12 (total local cost in State).

Add to this the State administration costs: \$132,393 12 (local cost) + \$14,779 03 (State cost) = \$147,172 15 (total cost).

To calculate the total cost per dose, divide the total cost figures by the number of injections given: \$147,172 15 (total cost) ÷ 228,264 (number of injections) = \$0 64.

## Changes in Demography Challenge Public Health

Future population growth of the south will take place in urban areas, stated Matthew Tayback, Sc D, di-

rector of the statistical section, Baltimore City Health Department. He based this prediction on trends in population growth and movement since 1920.

Discussing the implications for public health of this and related demographic trends in the south, Tayback urged public health authorities to reconsider their responsibilities. Of particular importance, he said, are these characteristics of an urban culture: (a) families have limited contact with their relatives, (b) large numbers are crowded into small areas, and (c) the rigid discipline of hours and methods of labor creates mental and emotional stresses.

Tayback considers adequate coverage of the population with medical and nursing skills the first essential for a sound preventive medical program. To a large extent, he said, this coverage can be provided through existing services of personal physicians and hospital centers. But in many instances, facilities for diagnosis of cancer, detection of early emotional disorders in children,

home nursing care, and the like, are lacking.

"The public health department will demonstrate its maturity and usefulness to the modern urban community by the statesmanship it exhibits in the solution of such unmet needs," he declared.

The full text of Tayback's presentation is scheduled for publication in the *American Journal of Public Health*.

## Says Psittacosis Control Should Start Now

Two approaches to the problem of controlling psittacosis were suggested by Martin P. Hines, DVM, MPH, chief, veterinary public health section, North Carolina State Board of Health.

The first is to accept the fact that direct control over birds carrying the virus is not possible or practical and to direct attention and efforts toward alerting the public and physicians to the dangers that exist, he declared.

The second is to consider reestablishment of a Federal ban on interstate and import shipments of psittacine birds except from certified aviaries. This would not be possible without funds, he asserted. If the cost of certified birds could be kept between \$15 and \$20 bird certification would be practical, he thought.

He described a number of past infections in humans that occurred in North Carolina and pointed out that the veterinary section is at present investigating 50 psittacosis cases. He claimed that the source of infection in North Carolina is parakeets, and, "with the exception of Texas and Oregon, it is the same elsewhere."

The incidence of psittacosis was low prior to 1951 when the Federal ban on interstate shipment of psittacine birds was lifted, Hines said, but during the past 4 years the incidence has increased almost 800 percent. The degree of increased psittacosis incidence will not be known until physicians are alerted to suspect psittacosis in atypical

## Florida Refines Cost Figure

A final study, completed June 30, 1956, is expected to show more precisely the cost of administering a single injection of poliomyelitis vaccine in Florida. In developing the 64-cent figure reported on this page, Dr. Stephens had as his immediate purpose the demonstration of a method of estimating the cost. In April 1956 Dr. Joseph Bistowish of Tallahassee completed a similar study in which he found 36 cents to be the cost of administration per injection. There is reason to believe that the actual figure is still lower.

was one of the weaknesses of the old system, in which home care was provided by physicians employed part time and hospital care was provided on a contractual basis by the Medical College of Virginia Hospital. The only records were charge slips. Physicians on home care did not see their patients in the hospital or outpatient clinics and received no reports from these services.

Under the new program, comprehensive medical care is provided through agreements and contacts with hospitals, clinics, nursing homes, and institutions for the incurably ill. The use of the patient's home for medical care is extended through use of the housekeeper service of the Family Service Society and equipment from the Sickroom Loan Chest. The Instructive Visiting Nurse Association and the Richmond Department of Public Health's nursing service, functioning as a combined unit, provide bedside nursing and public health services for patients on a referral basis. (A detailed description of the program was published in *A Study of Selected Home Care Programs, Public Health Monograph No. 35, 1955.*)

Another feature of the medical care program for the indigent is the dental clinic organized in 1950. It is sponsored jointly by the Richmond Department of Health and the School of Dentistry of the Medical College of Virginia.

### *Nursing Services*

Increasing demands for bedside nursing services led to the establishment of a combined nursing unit in which the Department of Public Health and the Instructive Visiting Nurse Association participate. Set up first as a demonstration project for South Richmond, the combined unit became citywide in January 1953.

Appraisal of the combined unit after 3 years' experience shows it to be economical and efficient, Holmes and his colleagues remarked. It provides better quality care and eliminates duplication of services. These advantages, they said, have made possible the provision of the bedside nursing care required by the new home care program.

### *Special Clinic*

In 1954, a committee was designated by the community council to study the problem of facilities for the handicapped child. The committee recommended that a diagnostic and evaluation clinic be established, that it be operated cooperatively by at least the Department of Public Health and the Medical College of Virginia, and that all related voluntary health agencies participate in the planning and financing.

On the strength of these recommendations, a governing board was established early in 1955. Under the leadership of this board, the Richmond Council of Jewish Women, the Medical College of Virginia, and the Department of Public Health, supported by 13 voluntary agencies, undertook to set up the proposed clinic. In November 1955, the clinic held its first session in facilities provided by the Medical College of Virginia.

### **Tulsa's Health Department Helps Plan City's Future**

In Tulsa, Okla., described as a "frontier village that had burst its seams," the health department has joined local city and county agencies in planning for the long-range expansion of the city and its environs beyond its present boundaries, according to Clyde B. Eller, director of the sanitation division of the Tulsa City-County Health Department.

The instrument through which unincorporated subdivisions in the counties surrounding Tulsa are achieving orderly growth is the Tulsa Metropolitan Area Planning Commission. Established in April 1953, the commission was created to cut across red tape hampering postwar efforts to control land improvement. A health department representative is a member of the technical review board of the commission.

### *Long-Range Studies*

Long-range planning and comprehensive zoning by the commission are developing patterns for tomorrow's thoroughfares, freeways, parks, shopping centers, and other com-

munity facilities for neighborhoods as yet unborn, Eller stated. The health department is sharing in these projects by planning an air resources study to avoid the necessity of an air pollution control program 20 years hence, by conserving and rehabilitating housing in present transition neighborhoods, and by seeking to anticipate future garbage collection and disposal problems, he added.

Eller said that the commission passes on the basic design of proposed subdivisions: on size, arrangement, type of streets and intersections; on access, size, and shape of lots; on location of easements and building of setback lines; provision for offstreet parking; public open spaces and other requirements.

In addition, the health department, through its representative on the commission's technical review board, passes on the adequacy of present land improvements which might affect the planned network of future streets, water lines, and sewers, Eller said. Many of the regulations under which the commission operates were drafted with health department advice and with the department's open support in public hearings, he added.

Eller quoted portions of two regulations as illustrative of the requirement that proposed water supply and sewage disposal systems have health department approval.

### *Approval Procedure*

Eller also explained the procedure by which subdivision developers obtain approval of sanitary installations:

The planning commission reviews the preliminary subdivision plat for obvious inconsistencies with design standards, then schedules it for discussion at the next weekly meeting of the technical review board. At that meeting, attended by the developer and his engineer, the plat receives detailed, constructive review by representatives of the city, county, and traffic engineer, the water and sewer department, the health department, and the planning staff. If warranted, representatives

Special education for leaders, beginning possibly with teachers since teachers train the future leaders of the country. (Studies by the Army and others have shown that units commanded by persons following sound principles of leadership, including a more permissive attitude toward their men, have fewer casualties resulting from emotional disturbances than units commanded by persons who do not recognize individual responsibility.)

Supportive services for families of the mentally ill, possibly as a part of a generalized public health nursing program.

Treatment in general hospitals for the mentally ill. The public health department could underwrite and supervise treatment for those unable to pay, as it does for patients with cancer, tuberculosis, or other diseases.

Custodial care with long-term treatment for those who do not respond to rapid, intensive treatment in the general hospital.

Special guidance for children exhibiting emotional disturbances not likely to be resolved by eliminating the adverse influence of maternal deprivation.

### *Research and Evaluation*

In determining the action needed in the community and evaluating the program once it is under way, it is necessary to develop criteria to use in selecting priorities, Rice stated. He listed the following criteria developed by the local and State mental hygiene staffs of the Georgia Department of Public Health:

The degree to which there is—

1. Readiness for the services on the part of the community or the administrative unit.
2. Potential for reaction with or effect on persons in positions of authority.
3. Facilitation of communications and prevention of isolation among communities, administrative units, and individuals.
4. Enhancement of personality growth and development.
5. Active public interest.
6. Potential for raising the gen-

eral level of mental health services in the community.

7. Potential for the prevention of mental illness.

8. Potential for community self-appraisal.

9. Socioeconomic capacity of the administrative unit or community to support the service.

10. Potential for integration with other services or programs.

Not only have these criteria been of value in determining what action is needed, but the process of outlining them has given us a better understanding of our own program, Rice declared.

After the director has reviewed the possible programs which he might develop and has weighed them against the criteria to determine their priority and has decided which to include, he must then decide what type of staff will be necessary to accomplish the objectives. Rice urged that the utmost care be exercised in selecting staff. Not only must their professional qualifications fit them for the job, but their personal ones as well, he said.

## **Blends City's Services For Long-Term Patients**

Joint planning of health programs by civic groups and voluntary and official health agencies, a method used in Richmond, Va., since 1906, has proved particularly effective in care of the chronically ill, according to a report by four members of the Richmond Department of Public Health.

The four members are: E. M. Holmes, Jr., M.D., M.P.H., director of public health for Richmond; P. W. Bowden, M.D., M.P.H., chief of the bureau of preventive medical services; W. R. Harton, Jr., B.S., chief of administrative services; and Alan N. Young, B.S., chief of health information. All are on the staff of the Medical College of Virginia.

Civic groups are brought into health planning through the Richmond Area Community Council. Through contracts and agreements with the official agencies, a large part of the voluntary agencies' funds is

expended for joint or cooperative projects.

The report by Holmes and his associates outlined the community council's work on chronic illness and related problems during the past 8 years. Council recommendations have been followed in reorganizing the medical care program for the indigent, forming a combined health department-visiting nurse association nursing service, and establishing various clinics.

The council initially assigned special subcommittees to study (a) existing hospital, nursing home, and convalescent facilities; (b) the community's rehabilitation facilities; and (c) facilities for medical and nursing care in the home.

The study of nursing home and convalescent care facilities, they said, revealed a great shortage of beds for Negro patients, a marked preponderance of beds for white women, and the problem of slow turnover of patients. It also showed that the cost in many homes was beyond the financial means of a large portion of the population. Another subcommittee offered the following recommendations:

1. That full use be made of private nursing home facilities on a contractual basis.

2. That the City Home, an institute for the care of the aged administered by the city's welfare department, be converted to a nursing home.

In 1953, the conversion of the City Home was accomplished. Admissions are coordinated through the health department's bureau of medical aid, which assures the use of the home as an integral part of the chronic disease medical care program.

### *Home Care Program*

Richmond's present medical care program for the indigent is based on recommendations of the community council subcommittee assigned to study the health department's home medical care services. This program, according to the report, provides both quality of care and continuity of service from the home to the hospital and back to the home. Lack of continuity of service

# technical publications

## Civil Defense Information for Food and Drug Officials

*Food and Drug Administration Publication. Unnumbered. 1955. Compiled and edited by Lowrie M. Beacham, Jr., and Harold V. Leininger, Homer J. McConnell, Joseph A. Matthews, and Alan T. Spiher, Jr. 188 pages; illustrated.*

The basic information about nuclear, radiological, chemical, and biological warfare agents in this civil defense handbook is designed to give food and drug officials, confronted with the aftermath of an attack, knowledge that will permit them "to decide what must be done and how it can be accomplished."

Part 1 covers postattack problems and operations and summarizes the probable duties of a food and drug official should an attack occur. Part 2 presents the scientific aspects of radioactivity, fusion, fission, and fission products, biological effects of ionizing radiation, chemical warfare agents, and the fundamentals of biological warfare. Part 3 reviews the basic scientific tools for a better understanding of radiology.

A limited number of copies of the handbook are available to those with civil defense responsibilities, without charge, from the Food and Drug Administration, Washington 25, D.C.

## Guide to Making a Survey of Patients Receiving Nursing and Personal Care

*Public Health Service Publication No. 451. 1955. By Jerry Solon, Dean W. Roberts, and Dean E. Krueger. 55 pages; exhibits. 75 cents.*

This guide, an outgrowth of a specific study by the Commission on Chronic Illness and the Public

Health Service, presents a tested method for States and local communities to use in discovering what types of patients and care are found in establishments or programs that provide nursing or personal care. Thirteen States participated in the study. Interest of other States has led to the issuance of the survey methodology for general use.

The types of information studied include personal and social characteristics of the patients, their medical condition, nursing care and attendance by physicians, activities engaged in, charges incurred, and sources of funds for care.

Interest in such a study may stem from health and welfare planning groups, standard-setting and licensing authorities, public welfare agencies financing care of clients, and from owners, governing bodies, and administrators of the facilities. To them the manual offers a method of conducting a survey, providing for their use a survey schedule, classification of facilities, techniques for collecting data, editing and coding instructions, and tabulating procedures.

## Nursing at the Clinical Center

*Public Health Service Publication No. 468. 1956. 12 pages; illustrated.*

A two-color, illustrated booklet just published describes the opportunities available to nurses in the Clinical Center of the National Institutes of Health.

The brochure explains how nurses serve as important members of the medical research teams, the clinical services to which they may be assigned, and what the typical nursing unit is like. By means of questions and answers, detailed information is given about the kind of training re-

quired, the salaries to be expected, and the opportunities for advancement.

The pamphlet is available to nursing schools, State nursing registers, hospitals, State and local health departments, and other agencies concerned with nursing activities.

## Patients in Mental Institutions, 1952

### Part I. Institutions for Mental Defectives and Epileptics

*Public Health Service Publication No. 483. 1956. 56 pages. 35 cents.*

Based on the 27th annual census of patients in mental institutions, this report is the first part of the sixth such census to be conducted by the National Institute of Mental Health.

For the first time since its inception in 1923, the annual report will be published in four parts, permitting a more expeditious and flexible medium of presentation. The other parts, *Public Hospitals for the Mentally Ill*, *Private Hospitals for the Mentally Ill* and *General Hospitals With Psychiatric Facilities*, and *Private Institutions for Mental Defectives and Epileptics*, will follow. Pending the publication of these parts, information on subjects treated therein may be obtained from Dr. Hyman Goldstein in the Biometrics Branch of the institute.

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This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

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of public utilities and of other local, county, and State groups also are present.

Their comments are used by the developer to revise his preliminary plat for presentation at the next convenient weekly meeting. The plat then passes to an official citizens' commission for approval, and the developer can proceed to prepare the final plat for filing.

If sanitary sewers are not available at the time the preliminary plat is submitted, the results of at least one soil percolation test and one 48-inch core test per acre are required. The plat must also be accompanied with an accurate topographic map. This material, together with aerial photographs and information obtained from field trips and actual experiences in nearby areas, permits careful analysis of all conditions. In the event that semipublic or private water supplies are planned, the availability of adequate, potable water must be substantiated in the form of information from test wells

or affidavits from competent geologists or nearby residents with wells.

These regulations apply both to formally platted subdivisions and to small tracts or lots, Eller stated, adding that all applications for proposed sanitary installations within the jurisdiction of the commission must be submitted to the health department.

## House Mosquitoes Breed During Georgia Winter

In Georgia from the fall line southward, *Culex quinquefasciatus*, the tropical house mosquito, breeds and survives throughout the winter, according to studies in Columbus and other cities of the State in 1955-56. These studies were reported by Orlin K. Fletcher, Jr., M.P.H., biologist, Georgia Department of Public Health, and Leon Flanagan, insect control officer, Muscogee County (Ga.) Health Department.

This evidence suggests the need for

starting mosquito control operations in late winter, Fletcher and Flanagan indicated. They reasoned that reproduction and survival of the mosquitoes during the winter results in a buildup of the mosquito population early in the spring and summer.

In Columbus, the studies demonstrated the presence of egg rafts, larvae, and both male and female adult mosquitoes in the street catch basins during most of the fall and winter months. Similar conditions were observed in other cities of the State.

Even in abnormally cold weather, they said, the mosquitoes are occasionally so numerous as to create control problems. In Columbus, complaints of biting activities became so vociferous in December that it was necessary to larvicide the street catch basins in one section of the city. In Baxley, complaints were received with such frequency during the winter months that routine larviciding operations were continued throughout the winter.

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## Course in Laboratory Diagnosis of Tuberculosis

A course in laboratory methods in the diagnosis of tuberculosis will be offered by the Public Health Service under the joint sponsorship of its Division of Special Health Services and its Bacteriology Laboratories of the Communicable Disease Center, Chamblee, Ga., from January 21 through February 1, 1957.

All grades of employed laboratory personnel, including laboratory directors and senior laboratory staff members, who are approved by their State health officers are eligible for the course.

Practical laboratory training in all phases of tuberculosis bacteriology, including preparation of culture media, microscopy, cultural procedures, diagnostic use of animals, and testing of drug sensitivity will be included in the course.

No tuition or laboratory fees are charged. Reservations for this course should be made well in advance.

Information and application forms may be obtained from Laboratory Training Services, Communicable Disease Center, Public Health Service, P. O. Box 185, Chamblee, Ga.



Flood waters carried animal carcasses, garbage, and rubbish through Winsted, Conn., in onrushing tide. Heaps of rubble had to be sprayed with insecticides. The Public Health Service shipped stores of these plus chemicals for rat control to New England from its Communicable Disease Center in Atlanta.

Sunday, August 21, saw the arrival in the Pennsylvania flood area of 55 sanitation personnel from all sections of the State. Health workers in other States responded with similar alacrity.

#### **Public Health Service Assistance**

Traditionally, the Public Health Service role in supporting State public health services is entirely supplementary, filling in where other health services are lacking or in need of reinforcement.

The first Public Health Service personnel

were dispatched from Region II in New York City on Saturday, August 20. By Friday, August 26, the maximum complement had been assigned to disaster-aid duty. In some instances, selected personnel completed special assignments and withdrew. Other specialists were assigned later. All told, 45 Public Health Service officers were assigned for flood disaster duty to the State departments of health, the Federal Civil Defense Administration, and the National Red Cross.

Public Health Service sanitary engineers assigned to State health departments in the affected areas assisted in evaluating incoming



# The Sanitary Engineer in Hurricane Floods

By FRANK TETZLAFF, C.E., M.C.E., K. C. LAUSTER, B.S.M.E., M.S.P.H.E.,  
and RICHARD S. MARK, B.S.S.E.

**W**ARNED by radio and newspaper stories on the morning of Friday, August 19, 1955, Public Health Service engineers in the New York regional office curtailed normal activities in readiness for Hurricane Diane.

The anticipated calls for assistance failed to come in during the day. By Saturday morning, August 20, the reasons became clear: Communications had failed, and few people were aware of the immensity of the disaster. In some States, authorities had to wait for the floodwaters to recede before they could determine what assistance would be required. Nevertheless, 10 inches of rain in a 24-hour period over an area extending from the Poconos in eastern Pennsylvania, across the Catskills and Berkshires, and into Connecticut and Massachusetts portended a national emergency.

Not until the following week did the extent

of damage become known. Experience could lend no clue. There was no previous record of so great a rainfall. In northwestern Connecticut, the maximum rainfall was estimated at 20 inches.

The newspapers quoted a general in the Army Corps of Engineers as saying, "Floodwaters have caused more damage in Connecticut in 2 days than all of the strategic bombing in the Ruhr Valley during the entire World War II."

In Winsted, Conn., floodwater from the Mad River reached 9 feet above any known previous record.

Easton, Pa., reported the Delaware River 5 feet above the previous maximum record.

A 300-year-old house in Connecticut, never before flooded, was swept away.

A 100-year-old dam in the Peekskill, N. Y., area had 7½ feet of water over its spillway. The previous record was 4 feet.

Three miles of a 36-inch water supply main was washed away at Scranton, Pa.

Diane came with such destructive force, augmented by bursting dams, that everything in her path was wrecked or damaged. Pavements were torn up. Watermains were ripped out. Highway and railroad bridges were destroyed. Houses and factories were obliterated. Automobiles were tossed around like toys. Worst of all, nearly 200 people were killed.

State health agencies mobilized their personnel immediately and deployed them into the stricken areas. The first arrivals were to make a quick reconnaissance and report on the need for additional assistance, equipment, and supplies.

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*Mr. Tetzlaff is chief, Headquarters Engineering Activities, Air Pollution Control Staff, Division of Sanitary Engineering Services, Public Health Service, Washington, D. C. At the time of the hurricane floods, he was regional engineer, Public Health Service Region II, New York City, and Mr. Lauster was assistant regional engineer. Mr. Lauster is now sanitary engineer consultant, Health Office, Federal Civil Defense Administration, Battle Creek, Mich. Formerly chief engineer and then deputy director of the Public Health Division, Economic Cooperation Administration Mission to Greece, 1948 to 1952, Mr. Mark is assistant regional engineer in the New York office.*

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Shattered, splintered avalanches of debris settled on city streets as flood waters roared through Waterbury, Conn. Food stores and other sources of necessities became inaccessible islands in a sea of wreckage like this.

The State health departments issued "boil water" notices in communities where contamination was suspected or known to exist. Heavy chlorination of the water was practiced. Breaks in the water systems were repaired. The "boil water" notices were in effect until water samples were bacteriologically satisfactory. In many communities the usual gas and electricity were not available for heat, and millions of chlorine (halazone) disinfecting tablets had to be distributed along with emergency supplies

of safe drinking water when piped water was not available. For drinking water many communities had to rely on emergency filtration equipment or on water brought in by milk-tank trucks, obtained from individual and school wells located on high ground or from other temporary supplies.

Milk supplies, in general, were not disrupted. The total milk supply was adequate. Raw milk supplies from dairies or pasteurization plants affected by floodwaters or power fail-

reports or in coordinating with the department staff and with the Federal Civil Defense Administration and the Army Corps of Engineers. Some were reassigned to county or local health departments or were deployed in the field as representatives of the State sanitary engineer. These groups functioned as personnel of the State or local health department to which they were assigned, and their authority stemmed from State or local authority.

Several sanitary engineers were detailed to the Federal Civil Defense Administration to appraise damage to sanitary facilities and to determine priority of the cleanup operations. Project applications submitted by local officials to the Army Corps of Engineers for restoration of damaged community facilities were first certified as to public health need by Public Health Service officers under Public Law 875 (81st Cong., 2d sess.). Public Law 875 authorizes the expenditure of Federal emergency funds by the Federal Civil Defense Administration. Accustomed as they were to working with State health departments, it was only natural for public health experts to follow similar procedures in this special assignment and to coordinate disaster activities among the various State, Federal, and volunteer agencies.

Officers assigned to the American National Red Cross appraised damage to individual homes and to other forms of housing. Cash allowances by the Red Cross for restoration of private property were based in large part on the appraisals they made.

To meet the Public Health Service's various responsibilities, the New York office drew on other branches of the Service for temporary duty personnel. The Chicago, Kansas City, Dallas, and Atlanta regions, the Washington, D. C., headquarters, the Robert A. Taft Sanitary Engineering Center in Cincinnati, and the Communicable Disease Center in Atlanta assigned Public Health Service officers to disaster-aid duty in the northeastern States.

Twelve Commissioned Reserve Corps officers on inactive status were called to active duty from the city health departments of Cambridge, Mass., Hartford, Conn., Pittsburgh, and Philadelphia; from the housing rehabilitation project in St. Louis; from Vanderbilt University in Nashville, Tenn.; from the State health de-

partments of New Mexico, Oklahoma, Tennessee, and Virginia, and from the health departments of Caroline County, Md., and Mecklenburg County, N. C.

In New York, the regional engineer and his two assistant regional engineers directed Public Health Service activities in the cleanup. The other engineers on the staff were assigned to emergency field duty.

### **Interstate Carrier Sanitation**

The only direct responsibility of the Public Health Service was for interstate carrier sanitation in the flooded area—the sanitation of water, milk, and food supplies which were used by interstate carriers and which might be affected in any way by the floods. Two sanitation specialists checked the condition of railroad watering points in the flooded areas. Their assignment was to find out from State and local waterworks officials whether supply sources for the watering points were affected by the floods and to notify carriers, by telephone or telegram, about the supplies which were unsafe.

Ten watering points were put on prohibited status until the water was safe for use and the sanitation satisfactory. One watering point was still on prohibited status as late as November 15, 1955. One company supplying ice cream to interstate carriers was placed on prohibited status. That action was necessary because floodwaters had temporarily disrupted the city water supply.

Field assignments for Public Health Service sanitary engineers ran the gamut from liaison with State and Federal groups to the organization and direction of spray crews, garbage disposal operations, and other "feet-wetting" tasks at the local level.

The rehabilitation of the 55 municipal water supplies which were either totally or partially interrupted was handled primarily by State health department personnel and by municipal water departments or by private water companies and their consulting engineers. In this connection, the mutual-aid system of neighboring communities assisting each other, which was set up during World War II, and which has been maintained continuously ever since, was highly valuable.



About 35 Federal food and drug inspectors were sent out to look for contaminated food and to supervise its destruction. The inspectors investigated the chance that prescription drugs might have been swept into the open where they could be picked up.

Much of the equipment and materials for conducting sanitation operations were available generally because the stricken areas were near sources of needed supplies. Thus, fortunately, chlorinated lime, insecticides, chlormating equipment, pumping equipment, bulldozers, and draglines were available. In addition, the Public Health Service contributed power sprayers, hand-pressure sprayers, warfarin rat-bait concentrate, malathion fly-control concentrate, DDT concentrate, red squill rat-bait pellets, halazone tablets, typhoid vaccine, tetanus antitoxin, and penicillin.

Housing sanitation criteria developed by Public Health Service officers in cooperation with the local health officers determined when homes could be reoccupied. Local personnel

were trained in consistent interpretation of the criteria.

Before residents were permitted to return to their homes, building inspectors checked the structural safety of each damaged building. Emergency sanitarians inspected each home to see that there was no water in the cellar and that the mud and silt had been removed; that there was no excessive dampness; that a water supply was available; that at least one sink and one water closet were in operation; that sewer lines were open; that walls, floors, and ceilings were clean and did not present any hazards; that electric wiring and fixtures were safe and satisfactory; that stoves and furnaces were clean and ready for use; and that fire hazards had been removed.

ures were diverted and handled through other plants.

Interruptions to sewage treatment and sewer service were not serious. Removal of debris that prevented sewage from flowing in the lines and that caused ponding in some residential areas was the main problem. Floodwaters backing up in a drainage pipe in one sewage treatment plant—the pipe did not have a shut-off valve—caused an estimated \$70,000 damage to motors, sludge-heating equipment, and electrical control equipment. The plant itself was not affected by floodwaters overtopping the entrance, but the structures of two activated-sludge tanks, empty at the time of the flood, were damaged. High groundwater caused the tanks to rise.

### Water and Sewer Systems

Sanitary engineers detailed to the Federal Civil Defense Administration were assigned to survey and report on the damage and the cost of temporary repairs to water and sewer systems, on the need for removal of debris, and on other sanitation needs of significance.

The following report of a Public Health Service sanitary engineer describes a typical situation encountered.

"Since none of the small towns I visited had either a water commissioner or a sewer superintendent, and only one had a city engineer (who had nothing to do with streets or utilities), the mayors or councilmen, usually laymen, needed engineering assistance and guidance. One seriously damaged small community which I visited 2 weeks after the flood had seen no public officials from the outside. They were trying to help themselves by renting heavy machinery for cleanup at a cost of \$600 per day, with no assurance as to how the rental fee was to be paid."

Public Health Service survey reports were used by FCDA in processing the applications submitted by communities for reimbursement under Public Law 875. About August 28 word was received that Army engineers had been instructed to move into the flooded areas and to award contracts for rehabilitation work.

Survey work continued as before, with the Public Health Service turning over its reports

to the Army Corps of Engineers. Consultation with the corps, relative to the protection of public health, produced gratifying results. One Army coordinator observed that a Service representative should advise every Army area on public health measures.

Much of the work involved supervision of the proper disposal of garbage and refuse spoiled meats and foods, and other putrescible matter. Prolific fly breeding was found in many places. It was feared that the rat populations would increase in dump areas if some control were not exercised. Some of the dumps were visited by as many as 1,000 trucks a day, hauling spoiled foodstuffs and other debris. Arrangements were made to have bulldozers cover the debris, and, when this was impossible, to have the material sprayed with DDT. Malathion was used on flies reported to be resistant to DDT. Rat control measures were taken in some areas.

Approximately 1 square mile in downtown Woonsocket, R. I., was badly damaged by floodwaters of the Mill and Blackstone Rivers. Debris and mud settled heavily in the section, an area occupied by about one-tenth of the population of Woonsocket, or approximately 4,000 to 5,000 people. The tenement-type structures in the heavily populated section often had stores on the first floor.

A Service engineer detailed to the Rhode Island State Health Department was assigned to direct the disposal of all wastes in the damaged area of Woonsocket. Because the space for disposal was limited, combustible material was separated from organic material and then burned—flame throwers were used to start the burning of wet combustible material. Organic material was dumped in landfills. In all, 45,000 cubic yards of refuse was burned, and 2,300 cubic yards was covered with earth.

In Waterbury, Conn., Service personnel assisted in the cleaning and decontamination of flooded restaurants and bars. Their work soon extended to barber shops, soft-drink bottling companies, meat-packing plants, and railroad freight-cars. Washing and chlorine rinse were considered adequate in most cases. Disinfection by gas was recommended where necessary and practicable. Laundering or dry cleaning was suggested for linens and upholstery.

# Health Activities to Combat Flood Damage

—Bucks County, Pa., Experience—

By MELVINA F. PALMER, R.N., M.P.H.

**D**URING and for several weeks after the flood caused by Hurricane Diane on August 19, 1955, the Bucks County (Pa.) Department of Health served in four general ways: coordination and direction, sanitation services, antityphoid inoculations, and other medical and nursing services including health education.

The county health director, as medical coordinator of the Bucks County Civil Defense Organization, acted as the medical adviser during the declared state of emergency. He directed and coordinated the health activities of the county, working with many local groups and agencies as well as with several national disaster relief groups. He also cooperated with the regional flood headquarters of the Pennsylvania State Health Department, temporarily established at Easton.

It is difficult to convey the meaning of "directed and coordinated" health activities during such an emergency, which affected the full length of the county bordering the Delaware River and the extensive lowlands along the snakelike path of Neshaminy Creek. It meant working around the clock for days, with the barest minimum of sleep and personally reviewing the flooded areas with civil defense and United States Army engineering groups. It meant keeping constant contact with local officials and being at the receiving and calling end of the telephone and short wave radio for

information upon which to base decisions, to answer multitudinous questions, and to give directions.

It included handling typhoid vaccine and providing tetanus antitoxin and other biologicals requested for the protection of hundreds of flood relief workers exposed to injury and negotiating for school buses to transport child evacuees from the Delaware Island camps to their homes instead of to an evacuation center as first proposed. (This same evacuation center was commandeered only a few hours later for an entire flooded town.) It meant coordinating health activities in the face of hysteria and establishing and maintaining an intranural communications system so that the staff could be quickly mobilized for work in areas of acute need. For example, there was the setting up of nursing services in the evacuation center in the high school at New Hope and the setting up and running of 2 typhoid vaccine clinics on Sunday night in 2 firehouses because of the demands of frightened people.

Demands upon the energy, tact, and technical skill exercised by the entire staff did not cease when the water subsided. Instead, the demands increased in diversity and magnitude. It was well into October before the normal activities of some phases of the health department program could be resumed.

## Sanitation

The debris laden waters of the Delaware and the Neshaminy caused widespread health hazards in the affected areas. Chief among these

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In general, officers returning from flood duty felt that local, part-time health departments lack the facilities, personnel, and funds to cope with emergencies. Their reports revealed that full-time health departments are far better equipped and have the trained personnel needed for these situations; that lessons learned over the years relative to the germ theory of disease may result in the condemnation and waste of large quantities of slightly soiled but salvageable articles; that trained public health personnel, properly organized and deployed, will produce manifold dividends in a crisis; that there is need for carefully developed plans for disaster-aid operations in which administrative lines and duties are well defined; and that close organization is needed at the top of any emergency service.

Nothing can substitute for training and experience in an emergency of this proportion.

Close and friendly cooperation between the Public Health Service, the State departments of health, the Army Corps of Engineers, the Federal Civil Defense Administration, and the American National Red Cross emphasized methods for producing results by the teamwork that was shown. Public Health Service personnel were highly complimentary of the manner in which these organizations carried out their responsibilities. There were, naturally, many misunderstandings, particularly during the initial phases of the operation, but these were ironed out as time went on and as understanding increased. These "growing pains" should serve as lessons, and the knowledge gained therefrom should be used to guide operations in future emergencies of this kind.

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## Insured Group Medical Care

A detailed picture of the 174 plans using group practice in providing their membership with benefits is described in a report entitled "Group Practice Prepayment Plans: 1954 Survey," by Agnes Brewster, Division of Research and Statistics, Social Security Administration, appearing in the June issue of the *Social Security Bulletin* (vol. 19, pp. 3-11). A general account of all independent medical care and hospitalization plans made by the Social Security Administration in 1954 appeared in the April 1955 *Bulletin*.

Sponsored by consumer groups, unions, fraternal organizations, employer and employee associations, and physicians, these benefit plans give coverage to 3 million members located in 34 States and the District of Columbia. Differences in the plans range from diagnostic services only to the full range of physicians' and specialists' services and hospitalization.

The article delineates the benefits of the plans, together with the methods of financing them. Included are widely or infrequently used physicians' services, obstetricians' and surgeons' services, routine laboratory and X-ray examinations and treatment by X-ray, basal metabolism tests, electrocardiograms, physiotherapy, appliances, extent of provision of ambulance services, and inclusion of pharmacies.

Some plans are fully prepaid; others made extra charges at the time of receipt of services, and still others are at cost.

The various methods used by the group practice plans in providing hospital care include ownership of hospital, contracting with hospitals in the community, cash indemnity benefits, and arrangements with Blue Cross or insurance companies completely separate from the plan. Days of hospital benefit range from 30 to 365.



Flood destruction leaves in its wake silt, seepage, and possible contamination of all water supplies. The Public Health Service supplied 2,000 membrane filter packets containing equipment for testing and sterilizing well water in a New England area.

with the typhoid inoculations. They had already established a pattern of teamwork in mass inoculations through their experience in the spring and summer with the Salk vaccine program.

Associated with the inoculation program was the unromantic task of preparing registration cards and the seemingly endless job of alphabetizing and sorting. Many volunteers and employees worked day and night to keep this important aspect of the inoculation program flowing smoothly at the 45 clinic sessions. In the county office there is a register which lists most persons who received inoculations.

#### Health Education

A fourth area of service provided by the county health department was the provision of public health information for residents and physicians. Four telephones, two in addition to those regularly provided, were in constant use for days. In addition, short wave radio from the civil defense office was used for sending important messages. Telephone queries related to water, sewage disposal, typhoid inoculations, as well as a multitude of health and sanitation problems. A physician, an epidemiologist from the Public Health Service, came in for a few days to help relieve profes-



was the contamination of basic food and water supplies. The Bucks County Department of Health prepared and distributed information on practical ways of re-establishing safe water and food supplies and of disposing of spoiled and contaminated items. The three sanitarians devoted much of their time for many weeks to testing samples from private and community wells in the flooded areas and to giving detailed

**Location of clinics, number and percentage of persons receiving one, two, or three anti-typhoid inoculations including those reported as being given by private physicians, Bucks County, Pa., 1955**

Clinic location	Number inoculations			Total
	1	2	3	
<i>Along Delaware River</i>				
Riegelsville <sup>1</sup> .....	972	272	994	2, 238
Upper Black Eddy.....	355	103	621	1, 079
Erwinna.....	58	42	241	341
Point Pleasant.....	72	59	185	316
Lumberville.....	117	47	178	342
New Hope.....	1, 025	293	1, 415	2, 733
Yardley <sup>2</sup> .....	1, 821	975	1, 734	4, 530
Morrisville.....	176	136	299	611
<i>Along Neshaminy Creek</i>				
Edison.....	46	45	94	185
Neshaminy <sup>1</sup> .....	391	267	686	1, 344
Lower Southampton <sup>2</sup> .....	2, 916	408	1, 344	4, 668
Hulmeville <sup>2</sup> .....	434	137	333	904
Eddington <sup>1</sup> .....	29	274	265	568
Newportville <sup>1</sup> .....	23	116	118	257
Croydon <sup>1</sup> .....	1, 016	186	221	1, 423
Physicians' offices.....	361	128	351	840
Total.....	9, 812	3, 488	9, 079	22, 379
Percentage.....	44	16	40	100

<sup>1</sup> The Bucks County Department of Health procured vaccine, provided registration cards, and assisted between and after clinics with registration and organizing of data.

<sup>2</sup> The first inoculations were started by such groups as the Lady Garment Workers mobile unit, the Burholme and Trevoise rescue squads, and at Yardley, the Byberry medical staff.

instructions on decontamination. Approximately 800 samples were taken and tested by the 3 men. Technical advice was also given on the proper disposal of waste, the care of food, the disinfection of water-soaked buildings, the disposal of spoiled foods and dead animals, and insect and rodent control. An emergency courier service for daily transportation of water samples was provided by the

American Red Cross Motors Corps so that results of tests could be more quickly obtained.

### Typhoid Inoculations

To prevent typhoid and to alleviate fear of the disease among large numbers of persons, the county health department participated in the administration and coordination of typhoid inoculations in 15 locations. A total of 44,025 inoculations were given. Only 40 percent of those receiving their first inoculations completed the series of three (see table).

The first clinics started on Sunday, August 21. Lights and sterilizers were run by emergency generators. The director, working quickly and closely with the several sources of supply, including the armed services, obtained the necessary vaccine. The syringes and needles, fortunately, were in adequate supply in the health department, having been obtained for the Bucks County cooperative Salk vaccine program. But equally important were teams of school and community nurses who assisted



Potable water is drawn from trucks located in key areas of Winsted, Conn. The Public Health Service assigned 45 technicians to stricken areas. Emergency field testing (bacteriological and chlorine residual) determined whether natural sources of water were safe or polluted.



# Histoplasmosis Conference

By MICHAEL L. FURCOLOW, M.D.

DURING the 20th century, histoplasmosis has emerged from obscurity more rapidly, perhaps, than any other disease. Formerly known as a rare and fatal malady, it is now seen with great frequency, and estimates are that in the United States alone 30 million people have been or are now infected. More remarkable than late recognition of the disease, however, was the discovery that it is caused by a fungus, since the fungi were described and connected with disease half a century before the role of the smaller bacterial agents was discovered.

With the realization that this disease occurs frequently, its study has advanced on many fronts. Mycologists, serologists, epidemiologists, clinicians, pathologists, and even general biologists have contributed to this relatively recent accumulation of knowledge.

With knowledge advancing, it is obvious that some fields develop faster than others, and that knowledge and achievements in certain areas may not be generally available to all interested persons. With this thought in mind, the Communicable Disease Center of the Public Health Service in 1952 sponsored a histoplasmosis conference which was attended by 48 persons interested in the study of this disease. The purpose of the conference was "to take stock of our accomplishments and consider the possibilities of the future." Sixty papers were presented in five sessions. Fourteen papers dealt with clinical, epidemiological, and pathological aspects

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of histoplasmosis; 13 dealt with mycological aspects; 12, with serologic diagnosis; 9, with the skin test as an epidemiological tool; and 12, with natural reservoirs of the fungus.



Public Health

MONOGRAPH

No. 39

The accompanying discussion covers some of the findings presented in Public Health Monograph No. 39, published concurrently with this issue of Public Health Reports. The conference was sponsored by the Communicable Disease Center, Public Health Service, Atlanta, Ga.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

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Proceedings of the Conference on Histoplasmosis held at Excelsior Springs, Mo., November 18-20, 1952. Public Health Monograph No. 39 (Public Health Service Publication No. 465). 319 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956. Price \$2.00.

sional persons in answering technical questions.

The county newspapers and commercial radio stations cooperated in the dissemination of information on the above subjects. This information (see below) was also mimeographed

and 30,000 copies were circulated in the flooded areas by Red Cross couriers, the health department staff, and civil defense workers, since few of the flood victims had regular channels of communication available to them.

## HEALTH PRECAUTIONS FOR FLOODED AREAS

issued by

### BUCKS COUNTY DEPARTMENT OF HEALTH

72 N. Main Street, Doylestown, Pa.

August 1955

*Private water supplies*—Boil all water 20 minutes before using. If you have no facilities for boiling water add  $\frac{1}{4}$  teaspoon of household Clorox (10 drops) per gallon of water. Stir vigorously, let stand for 15 minutes. Fill glass half full of this water, cover with hand, shake, and smell palm of hand. If you can smell chlorine, water is all right. If no odor, add 10 more drops and repeat process. Zonite, H.T.H., Diver-sol, B.K., Pittchlor, or any other common household bleach can be used. Follow directions on container. Continue to use these instructions until you know your water supply has been made safe.

*Wells*—Open-top dug wells should not be disinfected because they are always dangerous and easily subject to reinfection.

Shallow driven wells should not be disinfected since they are dangerous and subject to pollution (shallow meaning up to 30 feet in depth). If the well was tested and found unsafe prior to the flood, disinfection will be of no value. If the well was tested and found safe prior to the flood the well can be disinfected and restored to its original good condition.

*Method of disinfecting well*—Wells of ordinary size may be disinfected by the following means: Empty one-third of the contents of a 1-pound can of chloride of lime into a metal or stoneware bucket. Add a small amount of water to this and stir, thoroughly breaking up all lumps until a smooth thin paste is obtained. Add from 1 to 2 gallons

of water to this paste and stir well. Allow to settle for a couple of minutes and empty contents into the well. It is not necessary to put all of the lime settling in the bottom of the bucket into the well. Add 2 more gallons of water to the remaining lime in the bucket; stir, allow to settle, and pour into the well. It is important that the disinfecting solution mix with the water in the bottom of the well.

*Disinfecting homes, cellars*—If chloride of lime is available, it is well to wash down all walls which have been flooded with a solution of chloride of lime. Wherever possible it is also well to whitewash all walls which have been subjected to flood waters. Cellars which remain damp and any other places which might indicate need may be sprinkled with hydrated lime.

*Disinfecting home furnishings*—All clothing, bedding, and other similar materials may be disinfected with chloride of lime solution or by boiling. The chloride of lime solution will not act as a bleach on colored materials. Other materials which cannot be treated without injury with chloride of lime solution should be washed with soap and water and exposed to sun and air for several hours. In disinfecting by boiling, the actual boiling time should not be less than 20 minutes. In disinfecting with the chloride of lime solution, the article should be immersed or covered with the solution of strength so that the chloride odor is noticeable and kept immersed or covered for a period of 30 minutes before washing, rinsing, and drying.

*Food for private consumption*—All foods touched by flood waters, except canned goods, and all frozen foods which have lost refrigeration should be destroyed. Canned foods which have not been damaged are usually safe for consumption, but it is important that the outside of containers be sterilized before opening by dipping or washing container in chloride of lime solution, (not too strong) and then used only after having been thoroughly cooked.

*Food for sale*—The sale of foods damaged by flood waters is regulated by the bureau of foods and chemistry of the Pennsylvania Department of Agriculture.

*To dispose of human waste*—All washed-out privies and cesspools should be filled in. To make a temporary disposal unit, dig a trench 6 feet long and 1 foot wide. Place a blind around it. After each use cover the deposit with some earth. At the end of the day sprinkle it with chloride of lime.

Cover with earth. When the trench is nearly filled, stop using it; fill with dirt, mounded, and stamp firmly.

*To dispose of garbage, spoiled food, or dead animals*—Excavate a shallow pit about 2 feet deep. Use a bulldozer, if you have one. Dump in the material to be disposed of, almost to the ground surface. Compact it as best you can. Dig another pit beside it, and use this excavation to cover the first pit. Use at least 1 foot of dirt as cover. Burying refuse is better than trying to burn it, since it will be wet and will not burn.

# *Sampling Plan for a Small Household Survey*

Whether older persons would enter the labor force, if they could, is a question with many complications. In a study conducted in Hagerstown, Md., the Division of Public Health Methods of the Public Health Service attempted to develop an interview to determine the degree of interest in working among older people and the extent to which poor health might be an obstacle to their employment.

This monograph deals with the sampling aspects of the study and presents in more than the usual detail the decisions that had to be made and the procedures finally followed in sampling for a household survey. The methods used in estimating sampling error from the survey results are also set forth. Subsequent papers will cover the evaluation of the interview schedule, analysis of scales of availability for work in the Hagerstown trial, and the illness among older persons in the city as revealed by the interview.

The requirements of the study which chiefly determined the sample design were: (a) the need for a probability sample of all persons 45 years of age and over, exclusive of those in resident institutions, living within the city limits of Hagerstown; (b) the need for a sample of sufficient size to permit the analysis that was contemplated; and (c) the undesirability of conducting more than one interview in any one household.

When we employ probability sampling we can say in advance how much sampling error we are willing to tolerate and then select the sample so that statistical conclusions about the characteristics of the whole population will not have a sampling error greater than the tolerable limits, except very rarely. Probability sampling requires that the probability of including any individual in the sample be known. In order to

accomplish this, it is necessary to have some sort of list of all the individuals, or of units including all of the individuals, in the population that is to be sampled. In Hagerstown, this list was supplied by the city directory and a city map.



Public Health

**MONOGRAPH**

**No. 40**

The accompanying summary covers the principal characteristics of the sampling plan for a small household survey described in Public Health Monograph No. 40, published concurrently with this issue of Public Health Reports. The author is a biostatistician with the Division of Public Health Methods, Public Health Service.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

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Woolsey, Theodore D.: Sampling methods for a small household survey. Public Health Monograph No. 40 (Public Health Service Publication No. 480). 16 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956. Price 20 cents.

To preserve these papers in a single volume for future investigators, the proceedings of this conference are being published as Public Health Monograph No. 39, with a complete, up-to-date bibliography of nearly 800 references.

Here for the first time is summarized for the student most of the current knowledge of this intricate and interesting fungus disease. Here also are presented the baffling problems of the geographic localization of the disease and its apparent relationship to natural reservoirs of the fungus.

The clinical picture, with its variability from asymptomatic infection to bilateral chronic cavitory disease resembling tuberculosis, is also illustrated. The occurrence of epidemics is stressed. The usefulness of the skin test and serologic tests in diagnosis and epidemiological studies is reported. In addition to the difficulties of diagnosis, there are presented such public health problems as the prevention of a disease transmissible from nature rather than from other human or animal hosts, and the lack of adequate therapeutic measures. All of these things serve to point up one of the purposes of the conference, namely, to furnish guidelines for future research.

For the student of histoplasmosis, it is inter-

esting that the most important advances since the conference have dealt with the increasing awareness among clinicians of the prevalence of this disease. Especially is this true of chronic cavitory histoplasmosis as a problem in tuberculosis sanatoriums. In addition, advances have been made in pathological diagnosis by the use of special stains. An example is the Gridley stain, which has enabled pathologists to evaluate the frequency of histoplasmosis among patients undergoing surgery for suspected cancer of the lung. These refinements in pathological technique have supported the specificity of the skin tests reported during the conference.

Since the recognition of the prevalence of this fungus disease, there has been growing interest among clinicians and laboratory personnel in systemic fungus infections in human beings. This interest has resulted in increasing numbers of reports of infections with fungi previously considered rare or nonpathogenic.

In summary, it appears that this accumulation of knowledge of histoplasmosis may have many applications by public health workers, physicians, laboratory workers, and many others.

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## Advisory Committee on Indian Health

An Advisory Committee on Indian Health to assist in the improvement and expansion of medical care and health services to American Indians was appointed by the Public Health Service in May 1956.

The nine-member council will evaluate the Service's new Indian health program and assist in developing operating policies. They are N. B. Johnson, chief justice of the Supreme Court of Oklahoma; Anna Wauneka, chairman of the Navajo Tribal Council's Health Committee, Window Rock, Ariz.; Frank Ducheneaux, chairman of the Cheyenne River Sioux Tribal Council, S. Dak.; and Robert B. Atwood, editor and publisher of the *Anchorage Daily Times*, Anchorage, Alaska.

Also on the committee are Dr. Robert Neff Barr, secretary and executive officer of the Minnesota State Board of Health, Minneapolis; Dr. Fred T. Foard, director of the division of epidemiology, North Carolina State Board of Health, Raleigh; Dr. Alexander H. Leighton, professor of psychology, School of Industrial and Labor Relations, Cornell University, N. Y.; Dr. James Perkins, director of the National Tuberculosis Association, New York, N. Y.; and Dr. Raymond F. Peterson of Butte, Mont.

obtained as well as certain information about the demographic characteristics and labor force status of each person.

When the household contained only one member 45 years of age or older, all the questions on health and availability for work were addressed to this person. When there was more than one such member, the interviewer was provided with a sampling table which specified which member was to be interviewed in that household. Thus, in households with two persons in the 45-years-or-over class one of the two was selected at random, in households with three such persons one of the three was selected, and so on. In analyzing the results, it was necessary to restore the balance in this sampling by weighting each interview by the number of persons in the household who were in the age group of interest. This was done by reproducing the punchcard that was prepared from the interview, as many times as necessary.

The monograph also presents statistics showing the degree of success which the interviewers

had in reaching the sample. Of the total of 1,114 households in which an initial interview was desired, the interviewers completed 1,093 (98 percent). Six hundred fifteen of the households in which an initial interview was completed were determined to have one or more persons 45 years of age or over. The main interview was sufficiently complete to be included in the study in 600 (98 percent) of these. The 600 households contained 1,030 persons 45 years of age or older, but, as has been stated earlier, only one such person in each household was interviewed.

The monograph completes the exposition of the sampling methods employed with an illustration of the method of estimating the sampling errors from the survey results. A table of standard errors for percentages is also presented.

The sampling methods used in the Hagerstown survey are believed to have a wide range of application where the investigative technique is the interview-survey of a population sample.

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## Institutes in the Care of Premature Infants

A series of institutes for physicians and nurses in the care of premature infants is scheduled for the 1956-57 year at the New York Hospital-Cornell Medical Center. These institutes, which have been held each year since 1949-50, are sponsored by the New York State Department of Health and the United States Children's Bureau. They are designed for physicians and nurses in charge of hospital premature nurseries and special premature centers and for medical nursing directors and consultants in State and local premature programs.

Institutes are scheduled to begin September 17, 1956, November 5, 1956, and January 14, 1957. If the number of applicants is sufficient to warrant them, fourth and fifth institutes will be held beginning March 11, 1957, and early in May 1957.

Attendance at each institute is limited to 6 physician-nurse teams. The program for physicians lasts 2 weeks, and that for nurses, 4 weeks. Participants pay no tuition, and stipends are provided to help cover expenses during attendance. Early application is essential since plans are contingent on the number of applicants.

Additional information may be obtained by writing Box 143, Institute in the Care of Premature Infants, The New York Hospital, 525 East 68th Street, New York 21, N. Y.

The bulk of the sample was obtained by selecting what is known as a systematic sample of addresses from the directory.

Since directories are out of date as soon as they are issued, it was known that the sampling from the directory would have to be supplemented to allow a chance for households living at addresses not listed in the directory to come into the sample. This was managed by selecting a sample of blocks from a listing of all city blocks made up from a map of the city. Each block falling into the sample was canvassed, and all addresses were carefully checked against the directory. Any address in one of these sample blocks that was not listed in the directory was included in the sample. Finally, one area of the city where there had been a substantial amount of new construction was treated separately. All addresses in this area were listed and a sample was drawn.

Thus, the probability sample was carried out by dividing the addresses in the city into three strata: directory addresses, unlisted addresses scattered throughout the city, and unlisted addresses concentrated in new construction areas. An account is given in the monograph of the sampling in each of these three strata. Some unexpected obstacles were encountered, and the method of overcoming these is described.

The objective of obtaining a sample of sufficient size to support the desired analysis was achieved partly by guesswork and partly by providing a safeguard in case the guesswork was poor.

It had been decided, for reasons that will be presented later, that only one person 45 years of age or over could be interviewed in each household. The question was: In what proportion of the Hagerstown households would one or more persons who were past the 45th birthday be found? There were no available statistics on this point, but a guess was made that this proportion would be 50 percent. Since 500 completed interviews were thought to be a minimum number necessary for the analysis, it appeared that a sample of 1,000 households would be required to produce 500 households containing one or more persons 45 years of age or older. As a safeguard, however, it was decided that three separate samples of 500 households each should be selected. After the interviewing in

each sample had been completed, it would be possible by hand tally methods to determine not only how many completed interviews were available but also how large some of the frequencies that were important for the analysis would be. If a larger sample appeared to be needed, it was merely necessary to proceed with the interviewing of an additional sample of 500 households.

The population of Hagerstown in the 1950 census was 36,260; the number of households, approximately 11,400. To make allowance for inability to interview some persons, a sampling ratio of 1 in 21 for each of the three samples was decided upon. This ratio could be expected to provide 540 or more households in each sample. As it turned out, 56 percent of the households contained one or more persons 45 years of age or older. Consequently, it was found possible to stop the interviewing after the completion of the second sample.

Many of the questions in the interview were of a type that could be answered properly only by the person whom the question concerned. In other words, a proxy respondent could not be accepted. It was believed, however, that, if more than one person 45 years of age or older were to be interviewed in any one household, the replies of the later respondents would be influenced by overhearing the earlier interviews. It was, therefore, a requirement of the study design that a single respondent 45 years of age or over be selected from among those in this age group in the household. Furthermore, in order to meet the probability sample requirement mentioned earlier, the single respondent must be selected in such a way that the probability of any given individual coming into the sample could be known. In other words, the interviewer must be allowed no freedom in the selection of a respondent from among those 45 years of age or over who were found in the household.

This was accomplished by providing for opening questions to be addressed to any adult who could answer for the household as a whole. The first of these questions (which followed a brief introduction) was designed to find out whether there was anyone in the household who had passed the 45th birthday. If there was not, the interview was terminated. If there was, a complete roster of the members of the household was

supervised use of rauwolfia preparations in persons with essential hypertension.

### Effect on Mental Hospital Populations

Because of the magnitude of the problem of the hospitalized mentally ill, hospital administrators and public health, welfare, and other governmental officials are interested in finding some way either to reduce first admission rates to these hospitals, to effect a higher turnover of patients, or to keep readmission rates low and thus eventually to decrease the size of the resident populations. The tranquilizing drugs possess some of the necessary properties of an agent that could achieve such results. However, much more information is needed about the processes in society that lead to hospitalization and about the factors in the hospital and in the community that lead to release before any major portion of observed differences can be attributed to the tranquilizing drugs.

#### *Effect on First Admission Rates*

Data show that between 1940 and 1950 there had already been striking variations—and, in several instances, reductions—in age-specific first admission rates to State mental hospital systems. It is emphasized that there is a need for much careful epidemiological and social science research to illuminate the facts about “paths to the mental hospital” as well as “the barriers” hospital administrators place between the hospital and the community before one can determine what part the tranquilizing drugs may be playing in the reduction of admissions to mental hospitals.

#### *Effect on Release Rates*

Data are presented to emphasize the complexities in interpreting release rates from mental hospitals and also to demonstrate that even prior to the advent of the tranquilizing drugs there had been striking changes in these rates. Questions are raised as to whether increases in release rates that have been occurring over the years are due to (a) more intensive use of various psychiatric therapies, (b) differences in the kind of risk being admitted now as compared to years ago, (c) changes in attitude of staff toward level of improvement expected in

patients prior to release, (d) administrative factors and staff and patient organization within the hospital, or (e) changes in the community's attitude and that of the patient's family toward the mental hospital and the mentally ill.

Because of the large number of variables, well-designed experimental studies are necessary to evaluate therapies singly and in combination with each other and with various ancillary programs. In such studies there must be carefully defined diagnostic groups of patients, appropriate control groups, carefully specified therapeutic plans and staffing patterns, and specific objective criteria for evaluating results of treatment and for determining condition at time of release. The questions about the importance of the tranquilizing drugs on the outcome of treatment emphasize quite sharply the need for clarification of what constitutes psychiatric treatment, and as to what are the objectives of treatment within the hospital setting. If hypotheses with respect to the effectiveness of the tranquilizing drugs in accomplishing the goals of hospital treatment are to be tested, then it is essential that experiments and studies be devised that permit comparison of the effectiveness of a treatment method without use of the drugs with its effectiveness when the drugs are used.

#### *Implications for Staffing Patterns*

Not only have the numbers of personnel in mental hospitals been inadequate in relation to the number of patients but the turnover of personnel has also been relatively high. The milieu now made possible in the wards of mental hospitals following the introduction of the tranquilizing agents, namely, a marked reduction in or elimination of motor excitement in patients and in the reduction or elimination of the use of seclusion and restraint, raises serious questions about how existing staffs will have to be retrained and how staffing patterns should be changed, as well as how many additional or fewer personnel will be required.

#### *Followup Studies*

The need for carefully designed followup studies is urgent to determine the relationship of

# Problems in the Use of Tranquilizing Drugs

The tranquilizing drugs, such as chlorpromazine and reserpine, have been heralded as opening a new era in psychiatry.

Although these drugs may have such a potential, many facts are needed to assess the public health and social consequences that may arise from their widespread use. This monograph points to and discusses some major problems posed by availability of these drugs to the psychiatric profession and other branches of medical practice and the types of research needed to assess the effects of these drugs, particularly on mental hospital and outpatient psychiatric practice.

The tranquilizing drugs are being used on persons of all ages to treat not only a wide spectrum of psychiatric disorders but also hypertensive vascular disease and many other conditions. Their significant action is their ability to reduce motor activity, disturbed behavior, tension, and anxiety without producing sleep. The tranquilizing effect has been reported to be of value in the treatment of hospitalized psychotics by diminishing disturbed behavior without preventing patients from continuing to take part in psychotherapy, occupational, recreational and other forms of therapy. However, much research is needed to determine the immediate and long-range effect of the drugs both in psychiatric and nonpsychiatric patients. It is also necessary to establish appropriate dosages in relation to the various characteristics of the patient, such as age, sex, diagnosis, duration of illness, or general physical state.

Because of the tranquilizing properties of the drugs, information is needed on their psychological effects and the characteristics of the individuals in whom these effects are likely to occur. In this connection, the results of several recent studies show a significant incidence of severe depression, with suicidal tendencies in some in-

stances, in persons being treated for hypertensive vascular disease with reserpine and other rauwolfia products. This constitutes a major contraindication to the indiscriminate and un-



Public Health

MONOGRAPH

No. 41

The accompanying note summarizes the principal points discussed in Public Health Monograph No. 41, published concurrently with this issue of Public Health Reports. The author is chief of the Biometrics Branch of the National Institute of Mental Health, National Institutes of Health, Public Health Service.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

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Kramer, Morton: Public health and social problems in the use of the tranquilizing drugs. Public Health Monograph No. 41 (Public Health Service Publication No. 486). 32 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956.



# Cooperation Between Departments of Health and Welfare

By JONAS N. MULLER, M.D., M.P.H., and PEARL BIERMAN, M.A.

IN 1952 the Joint Committee on Medical Care of the American Public Health and Public Welfare Associations posed the thesis that the interests and practices of public health and public welfare were bringing the agencies concerned closer together(1). This was not a new thesis but a restatement that was especially timely in the light of the Social Security Act amendments of 1950(2, 3). These amendments made possible federally matched direct payments to the providers of medical care for certain needy persons and established the Federal-State program of aid to the permanently and totally disabled.

During the past few years, through a field

survey in 8 States and 10 local areas, the APWA and the APHA have sought to determine what cooperative activities are conducted in some official health and welfare departments.

## Method of the Study

The States and localities selected for study were among those in which we might expect to find an optimum potential for close working relationships between the departments. These were:

California: Alameda County, city and county of San Francisco, San Mateo County; Maryland: Carroll County; Massachusetts: city of Quincy; New Jersey: city of Newark and Essex County; New York: Ulster County; Oregon: city of Portland and Multnomah County; Washington: city of Seattle and King County; Wisconsin: Rock County and the cities of Janesville and Beloit.

In each State, we arranged meetings with personnel in the State health and welfare departments, and in at least one local area. Occasionally some State personnel accompanied us on local visits. The meetings were informal and frequently led into topics which heretofore had not been considered jointly by the health and welfare staffs.

The typical meeting found top representation from administration, medical social work staff from both departments, medical directors or consultants of the welfare departments, supervisors of public health nursing, and, espe-

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*This report is an adaptation of a paper presented by the authors at the 83d annual meeting of the American Public Health Association, November 17, 1955, and of a paper prepared and presented by Dr. Muller at the Biennial Round Table Conference, American Public Welfare Association, December 2, 1955.*

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diagnosis, sex, age, length of hospitalization, therapy, and the socioenvironmental factors encountered by patients in the extrahospital world to relapse or successful readjustment. The tranquilizing drugs add further complications. For example: How should dosage levels used in the hospital be modified up to time of release? When the patient is released, on what dosage should he be maintained, if any? What problems does the use of these drugs pose for the family? What information should the family be given? What resources in the community are needed to follow up these patients adequately so as to prevent serious complications from developing in the patient, to detect complications when they have developed, and to take appropriate steps to safeguard the patient, his family, and the community as well as to facilitate readjustment of the patient to the extrahospital world?

#### Effect on Outpatient Medical Practice

Uses of the tranquilizing drugs have suggested the possibility that relatively inexpensive

agents are available that will make it possible to treat many types of psychiatric disorders on an outpatient basis. It has also been suggested that these drugs may reduce the need for psychiatrists in isolated communities where the general practitioner can now treat some of the milder forms of mental disorders. However, the widespread use of these drugs in our current state of knowledge concerning their immediate and long-range effects might also produce conditions that could tax seriously the limited psychiatric resources of the Nation. Some of the possible problems that these drugs may create are considered in relation to the psychiatric manpower of the Nation and the availability of outpatient and other community psychiatric services. It is suggested that administrators of community mental health programs scrutinize carefully the current organization of psychiatric outpatient and inpatient services to determine how they must be modified and reorganized to meet the new demands that may be placed on them by the advent of the age of pharmacotherapy in the psychiatric disorders.

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## Advisory Council on Vocational Rehabilitation

Mrs. Spencer Tracy, Russel W. Brothers, and Chester W. Haddan were appointed in May 1956 to 4-year terms on the National Advisory Council on Vocational Rehabilitation.

The 12-member council reviews applications submitted by private, nonprofit, or public organizations seeking Federal funds for partial support of research and demonstration projects or of special facilities concerned with vocational rehabilitation problems of nationwide significance.

Mrs. Tracy, president and director of the John Tracy Clinic of Los Angeles, has had long experience with problems of the deaf and hard of hearing. She has been associated with many organizations working on behalf of the handicapped and is the author

of numerous articles dealing with hearing impairments.

Mr. Brothers, secretary and treasurer of the M. P. Brothers Co., of Nashville, Tenn., is chairman of the Tennessee Governor's Committee on Employment of the Physically Handicapped and has long taken an active interest in the Tennessee vocational rehabilitation program.

Mr. Haddan, a specialist in the artificial limb field, is president of the Gaines Orthopedic Appliances Co. of Denver, Colo. He is also a member of the prosthetics research board of the National Research Council, the committee on artificial limbs of the American Medical Association's council on physical medicine, and the Colorado Governor's Committee on Employment of the Physically Handicapped.

and may soon be as acute in other welfare programs, such as services for the aged.

Welfare departments are acquiring medical administrative machinery, knowledge, and skill. They have long been concerned with long-term illness and disability and with the aged. Services for unmarried mothers, for dependent and foster children, for the aged, and for the prevention of delinquency all involve extended health responsibilities. The alert health officer is interested in all these areas and will help the welfare department find efficient methods of providing the required services. The cooperative efforts of health and welfare agencies will improve the health of the entire community.

### Public Health Nursing

Public health nursing services are the most widely used of the health department services available to clients of public welfare agencies. Extensive field relationships between caseworkers and public health nurses, for the most part, appear to revolve around episodes or cases. These relationships are generally informal and unplanned, often the result of an accidental joint visit to a household. In only 1 of 8 States was there evidence of State policy directed at promoting such relationships except in the limited field of institutional inspection. This lack of definition of responsibility generally applies to local agencies as well.

In a number of communities, however, the services of public health nurses have been made available systematically to people served also by the public welfare agency. In Ulster County, N. Y., nurses from the county health department provide bedside care, including injection of medications, as an extension of the teaching program, for welfare clients who are homebound. Staff nurses obtain information concerning the family and home from the welfare caseworker. Case conferences are organized by field workers of the two departments on the initiative of either staff. Informal conferences, apparently more common, also are reported in the regular work sheets.

Some nursing services also are available at local nursing stations and at health department headquarters. The increasing caseload among the aged has increased the bedside care func-

tions of the nurse although the number of patients is not great. Staff representatives of the health and welfare departments have met to consider methods of meeting the need for home nursing service without disrupting the public health nursing program.

The Ulster County public health nurses bring advice on nutrition to welfare families. Nutrition consultation from the State health department thus serves the local welfare agency indirectly. Public health nurses also survey health care of children in foster homes.

This county has a well-developed orientation and inservice training program for staff nurses which draws upon the welfare staff. Much of the teaching is carried out in case conferences which involve all of the community agencies related to the particular case. At the time of our visit, there was no such use of health department personnel in the public welfare agency.

### Services for Children

State public health personnel participate actively in both administrative and clinical services for child welfare. Standards for child care facilities and programs of all types are often developed jointly. In several States, the maternal and child health division of the health department provides medical administrative and clinical consultation to the division responsible for child welfare in the welfare agency. In Maryland, a good deal of time has been spent on how, and by whom, health supervision should be provided in foster care and adoption programs. In Wisconsin, requests for consultation have been limited to problem cases, but the board of health participated in establishing the standards for medical care in the foster home program, as well as the standards used by the division for children and youth of the department of public welfare in licensing children's institutions and day care centers.

Locally, the health department is likely to be engaged only in direct clinical services—child health conferences, crippled children's services, and, to a lesser extent, child guidance clinics. Occasionally these services are operated jointly, and the crippled children's services may be under the local welfare department. Relation-

cially from the welfare department, staff responsible for development of policy and standards. In one area, only two administrators appeared. At the other end of the scale, the chiefs of practically all operating units in both departments met with us.

Open-ended, but directed, questioning was used. Each agency was first asked to describe its overall program, with particular attention to the provision of health services to needy persons. Questions were then directed at relationships in regard to referral of patients, exchange of information, followups, and continuity of service. An attempt was made to call for illustrations of specific problems such as services to tuberculosis patients and to their families; preventive services to mothers and children; the determination of incapacity in aid to dependent children and aid to the permanently and totally disabled and the application of preventive and rehabilitative services once such a determination was made. Case histories often were used to illustrate relationships or the lack thereof, particularly by the local agencies.

This more or less clinical approach was followed by questions designed to bring out interdepartmental relationships arising out of service responsibilities. Since this was generally the most successful method of achieving information, the present report is organized under service titles.

In the preparation of this report, we have drawn upon the meager literature on health and welfare department relationships and also upon the knowledge of agency operations gained in work with such departments.

### Patterns of Cooperation

There are many patterns of cooperation between health and welfare agencies which differ in form and degree. Most of them relate to activities somewhat remote from the recipient of service, and few are vigorously directed at the prime goals of health. Moreover, cooperation is practiced relatively seldom and is rarely explicitly defined as policy.

This is not to say that there is noncooperation between health and welfare staffs. There is often simply no relationship on the adminis-

trative level. In this connection, Dr. Palmer Dearing, Deputy Surgeon General, Public Health Service, said before the Conference of State Public Welfare Directors in 1950:

"It is conceivable that an effective program might be developed without any formal provisions for cooperation." However, he went on hopefully to say that, "if health and welfare staffs work closely and congenially together and consult spontaneously whenever they deal with interrelated problems, they will inevitably make plans together and define areas of responsibility . . ." (2).

Unfortunately, we have found that many health officers specifically avoid the responsibilities arising out of the fact that disease is most prevalent among persons known to welfare agencies. We were told frequently that the health department feared being labeled as an agency for the indigent if it made any special provisions for health services to the needy.

Public welfare departments—dedicated to the prevention of abnormal dependency and to the achievement and maintenance of normal, secure, and productive social living—have the same objectives as public health agencies.

To help clients realize these goals, the welfare department will require professional help in the administration of a medical care program. The definition of medical care is a broad one and includes many of the personal health services which may be provided by or through the health department (1).

"Medical care is essential for individual well-being. Its objectives include the promotion of health, the prevention of disease and disability, the cure or mitigation of disease, and the rehabilitation of the patient. Medical care for needy as well as other persons must be geared not only to treatment of disease but also to preventing its occurrence or progress. For those needy persons who are already disabled, all possible use should be made of rehabilitation services so that individuals may be restored to productive living, may cease to require the continued services of other members of the family, and may be enabled to live as useful and happy lives as possible within the limitations of their disabilities."

If preventive services are not known to the welfare program, if they are difficult to obtain, or even refused, then the welfare department will have to establish them. This need has been acute for some time in regard to child welfare

control programs for fiscal years 1954 and 1955 (7) notes as one of the continuing administrative problems "lack of coordination of program activities among all interested State and local agencies."

Cooperation in disease control by State agencies was not evident during our visits. One agency head feared that any notification to welfare clients of the availability of preventive services could be considered coercion and therefore was not an appropriate public assistance activity. A welfare client, he thought, should have the normal opportunity to find out that a chest X-ray survey was due in his neighborhood and any action by the public assistance agency concerning the survey might make the client feel that he had to have an X-ray.

In Wisconsin, however, where the State anti-tuberculosis association and the State board of health cooperate in sending mobile X-ray units around the State, each county welfare department is informed, through the State welfare department, when the unit is coming. All possible channels are used to encourage county agency clients to use the service. The latest tuberculosis control report of the Wisconsin State Board of Health notes that nursing homes are receiving special attention. Oregon also

reported special efforts in regard to nursing homes with indigent residents. In this State, representatives of both State boards confer to arrange care for tuberculosis patients.

We found that few local health departments have encouraged the welfare departments to give new clients a chest X-ray. A somewhat larger number of departments, State and local, notify local welfare agencies of chest survey schedules and help them achieve a high level of client participation. A few health departments have conducted campaigns to find tuberculosis among residents of nursing homes, homes for the aged, and lodging houses for single men. Health departments not infrequently provide X-ray facilities, as well as tests for syphilis, for screening possible foster parents or operators of child care facilities. Routine health examinations for personnel of other care facilities, or for health or welfare department staffs are relatively rare.

After diagnosis, coordinated services are needed to help a patient to recover. The patient and his family need to understand the disease and the treatment program. The patient requires knowledge of his family's status and assurance that they will not be neglected. With the patient under hospital care, there

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## Facilities for Research in Health Related Sciences

The Health Research Facilities Act of 1956, signed by President Eisenhower on July 30, 1956, authorizes the appropriation of funds not to exceed \$30 million for each of 3 years to assist in financing the construction of facilities for research in the sciences related to health. The act defines these sciences as including medicine, osteopathy, dentistry, and public health and the fundamental and applied sciences when related thereto.

Assistance will be in the form of grants-in-aid to public and nonprofit institutions. The Federal Government's share is limited to not more than 50 percent. Costs for the acquisition of land or off-site improvements and obligations made prior to the award of the research grant are not creditable for matching purposes.

The Congress has appropriated the first \$30 million to the Public Health Service. The funds are to be used, as the act specifies, in providing either or both (1) additional research facilities through the construction and equipping of new buildings or (2) the expansion, remodeling, alteration, and equipping of existing buildings.

A National Advisory Council on Health Research Facilities will establish policies and approve regulations for the administration of the new program. A grant-in-aid must have approval of the council before it can be awarded by the Surgeon General.

The Division of Research Grants, National Institutes of Health, Bethesda 14, Md., will supply application forms and any information requested.

ships are probably developed most extensively in the crippled children's program.

In many States, services for handicapped children engage both State health and welfare agencies, and sometimes, other State and local agencies as well. Primary State responsibility for the State-Federal program is in the health department in 32 States and Territories, in the welfare department in 8 States, and in a combined health and welfare agency in 1 State. In the remaining 11 of the 52 States and Territories reporting in 1954, the program is administered by special commissions (4 States), by departments of education (3 States), and in 4 States by the State medical schools (4). Where cooperation is practiced, relationships may extend to case finding, organized referral systems, case conferences, foster home placement, acceptance of responsibility for payment for care, the determination of eligibility, and clinical services.

In California, the State program of crippled children's services is administered by the health department, but in about half of the counties the welfare department has been assigned responsibility by the local board of supervisors. On request, consultation may be provided by either State agency whose field workers maintain an active relationship to determine the best ways of providing consultation.

In Massachusetts, the public assistance and child guardianship divisions of the department of public welfare have agreed to pay the costs of care for their clients when crippled children's service funds are lacking in the department of public health.

In New York State, case finding for the crippled children's program is an accepted responsibility of welfare workers, as well as of health department staff. As long-term custodial care for children who cannot be rehabilitated is difficult to locate, problem cases are discussed by staff members of both agencies. In practice, most of the relationships in New York's program are between the State health department and the local welfare departments. The active support of this relationship by State welfare department policy is important. The welfare departments aid in finding foster homes for handicapped children. For children who are not found eligible for the Medical Rehabilita-

tion Program (the crippled children's service in this State), welfare resources are occasionally called upon to provide services such as certain forms of orthodontic care.

In North Carolina, financial eligibility for care under the crippled children's program of the State board of health is determined by the State board of public welfare. This service, based upon a written agreement, is part of the State's policy of applying a uniform standard of eligibility for health services at State expense. In addition to investigation and certification of eligibility, the State board of public welfare agrees to assist with case finding, to provide transportation for patients to and from clinics and hospitals, to help in locating special equipment and services when crippled children's funds are limited, and to provide casework service to the patient and family in the adjustment to long-term treatment. These services are provided through the county welfare departments under instructions prepared by the State board of public welfare and reviewed by the crippled children's department of the State board of health (5). Similar agreements define the responsibilities of the board of public welfare in relation to the cancer program of the State board of health; tuberculosis sanatoriums; correction of defects under the school health program of the board of public instruction.

### **Tuberculosis Control**

The association between tuberculosis and economic deprivation calls for vigorous measures to prevent infection and to treat patients served by welfare agencies. In this area of communicable disease control, interdepartmental cooperation is highest, particularly between local agencies.

In their 1950 reports to the Public Health Service, 11 State welfare departments reported some type of tuberculosis control or hospitalization responsibility (6) although major responsibility rested with the State health department. It would be reasonable to expect some kind of relationship between these two State agencies concerning their responsibilities for certain tuberculosis control activities. Nevertheless, the annual report on State tuberculosis

cient knowledge to be an effective case-finding instrument for the noncommunicable chronic diseases.

### *Determination of Disability*

Health department clinics in orthopedics, venereal disease, rheumatic fever, chest diseases, and cerebral palsy often help welfare departments determine a client's disability. The general medical services, including clinics, of about 70 local health departments across the country are the major or sole source of medical care for welfare patients in these areas. A few of these departments, such as the Baltimore City Health Department, have attempted to work toward the prevention of disease, especially chronic disease, by offering physical examinations. A few, such as the health department in Newark, N. J., have disability evaluation units. And here and there, a local health officer serves as medical member of the welfare department's review team for eligibility for aid to the disabled.

### *Rehabilitation*

Aggressive concern with rehabilitation is a relatively recent development in welfare work (8), encouraged undoubtedly by the newest category of public assistance, aid to the permanently and totally disabled. Accompanying this new interest, however, is a certain feeling of frustration due, no doubt, to many long years of failure to obtain rehabilitation services for public welfare clients. Hence, a few welfare departments have developed their own rehabilitation programs (9).

For most departments, this choice is neither wise nor possible. It ignores the resources of the local health department for the development, application, and coordination of rehabilitation services. Certainly the public health staff can help welfare workers concerned with rehabilitation problems by interpreting the social meaning of medical findings and acquainting them with the medical aspects of rehabilitation.

There are a few places, however, where health departments have put their long experience with habilitation and rehabilitation of crippled children to effective use for all age groups. We know of only one State where this is policy:

Washington, where every local health officer serves as medical consultant to the district vocational rehabilitation counselor. Weekly meetings serve the day-to-day administrative needs of the vocational rehabilitation program. In addition, monthly conferences include any other local agency with an interest in a case on the agenda. The State health officer feels that this arrangement has been successful.

The California State Department of Public Health has been of help in the development of policies and procedures for improving opportunities for rehabilitation among the disabled parents of recipients of aid to needy children. The detailed story of the several interrelated projects involving the State department of social welfare, the bureau of vocational rehabilitation, and the department of public health is told in a series of publications (10-14).

### **Institutional Standards and Licensure**

Probably the best developed cooperative relationships at State level revolve around institutions, particularly their licensing. Information obtained from 44 States in 1953 indicated that in 30 States the health department had legal responsibility for the program for all institutions serving older people (15). Six States assigned to the welfare department the accrediting program for all such institutions. And in eight States, responsibility was assigned to the health or welfare department according to the nature of the institution. The 1950 State health department reports to the Public Health Service indicate that, while health departments have major responsibility for licensing medical institutions in most of the States, welfare departments are responsible for most child care facilities in the States where there are licensing provisions; and in a few States, the welfare agency is responsible for the general or special hospital facilities (16).

Expert guidance, consultation, and field service from personnel skilled in health and social services are required if programs of licensure or other forms of accreditation are to be more than perfunctory. Both health and welfare agencies know that licensing can be a "tool" to achieve a higher level of care and service. General health care, rehabilitation, the prevention of

should be periodic reports to and from the community agencies concerned with the patient and his family. Case conferences to set rehabilitation goals and make appropriate pre-discharge plans smooth the path back to active life. When care on an ambulatory basis becomes possible from a clinical point of view, social, economic, and public health problems which stand in the way of such therapy must be solved by coordinated efforts.

The integrated service of a combined local department of health and welfare, as in San Mateo County, Calif., has pioneered in meeting the needs of patients with tuberculosis. This department is responsible for the county institutions as well as for the full range of public health and public welfare services.

The entire tuberculosis control program is under the medical director of the sanatorium, to assure continuity of service from case finding and diagnosis through followup. A full-time public health nurse at the sanatorium keeps liaison with the field staff. Problems relating to the treatment plan for a patient are usually worked out in the district by frequent and informal meetings between the public health nurses and caseworkers.

If difficulties require administrative consideration, the family is brought to the attention of the supervisors. Medical consultation is immediately at hand. The staff confers on patients under care twice each month. A representative of the social service division participates whether or not the patient receives public assistance.

Planning 2 to 3 months ahead in anticipation of discharge from the sanatorium applies to every public patient in San Mateo County. The sanatorium itself has a rehabilitation program in which a representative of the district office of the State bureau of vocational rehabilitation shares. Psychiatric services also are provided. Thanks in large part to the relationship established by the department in this program, an unusually low proportion of patients leave the sanatorium against medical advice.

### **Services for Chronically Ill and Disabled**

In most communities, unfortunately, relationships in regard to chronic diseases and adult

rehabilitation are not strikingly different from relationships in regard to disease control, with a few possible exceptions.

### *Basic Studies for Program Development*

In two States noted for their chronic disease programs, California and New York, departments share actively in basic studies for program development. New York State studies have been concerned with the extent of chronic illness and disability. In California, the director of the State department of social welfare served on the advisory committee for the chronic disease investigation conducted for the legislature in 1949 by the State department of public health. Welfare directors of 38 counties contributed their experience as well. Welfare officials contributed also to the 1954 health survey conducted by the chronic disease service of the State department of public health.

### *Mutual Support of Legislation*

Cooperation on legislation, though somewhat rare, was noted in several States. Development of the Lemuel Shattuck Hospital in Boston, operated by the Massachusetts Department of Public Health, may be credited to the joint planning of the health and welfare departments and to their mutual assistance in preparing and supporting legislation required for its construction. This hospital for persons with chronic diseases is a base for both service and research.

### *Case Finding*

Case finding is not widely practiced in welfare departments except in relation to communicable disease. For example, no State welfare department in 1950 reported to the Public Health Service responsibility for diabetes control (6); only 7 State welfare departments reported contributing to heart disease control; only 8 to cancer control. This listing, however, does not cover "unofficial" responsibilities. Massachusetts, for example, is not included although the State health department's 26 tumor clinics regularly refer to the welfare department cancer patients who require and are unable to afford long-term care.

While welfare departments do play a part in case finding for certain communicable diseases, most welfare staffs do not yet have suffi-



sultation to relate payments to services needed and received.

Day care centers for children, a responsibility of the Oregon Public Welfare Commission, must have standards certified by the board of health to be eligible for monthly State aid. Group care homes for mentally and physically handicapped youngsters, licensed by the board of health, must meet standards set in part by the public welfare commission.

In Maryland, an interdepartmental committee sets criteria for rates of payment by the welfare department for nursing home care. A similar joint committee, with representation from health, welfare, and education develops standards for the licensure of day care centers in Maryland.

In Massachusetts, day care facilities for chil-

dren, licensed by local health departments, use standards developed by a joint committee of the State departments of public health, public welfare, mental health, and education. Consultants of these departments are available to the local areas on request through the district offices of the State department of public health.

Illinois provides another "example of the way in which the health and welfare departments can work together to improve the service provided." The State department of public health, the licensing agency, sends to the public assistance agency copies of all letters to individuals operating or planning to establish nursing homes. This enables the State public assistance agency to exchange information with county welfare departments concerning nursing homes which have been or are about to be licensed.

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## Nine Grants for Hospital Research

Nine grants totaling \$367,182 for new research and demonstrations in hospital service and administration were announced in July by the Public Health Service of the Department of Health, Education, and Welfare.

The research is aimed toward improving the care of patients in hospitals and health facilities, reducing costs, and helping to make the benefits of hospital and health services more widely available.

The University of North Carolina School of Medicine, Chapel Hill, will study the referral of patients from rural areas to the outpatient clinic of the university hospital.

The University of Tennessee College of Medicine, Memphis, will demonstrate how a coordinated hospital plan for the entire State can be developed.

The University of Michigan, Ann Arbor, will initiate two projects: (1) A study of how the organization, staffing, and procedures in 20 Michigan hospitals are related to the type of care the patients need and receive, and (2) a study of the relationship of administrative and supervisory practices in hospitals, motivations and job satisfaction of the employees, and effectiveness of job performance and organization.

St. Louis University, St. Louis, Mo., will develop a program of graduate study in hospital administration at the doctorate level for advanced students to carry on research.

Columbia University School of Public Health and Administrative Medicine, New York City, will study the influence of different patterns of organizational and community relationships and of new hospital construction on the quality of medical, hospital, and related health services.

The Council of Jewish Federations and Welfare Funds, New York City, will study the coordination of the facilities of the general hospital with the resources of other medical and related community services.

The Minnesota Department of Health, Minneapolis, will initiate a project to demonstrate how the quality of service given patients in State hospitals can be improved through the development of methods for inservice training.

The American College of Physicians, Philadelphia, will study methods for minimum standards of quality and efficiency for evaluating the practice of internal medicine in hospitals.

secondary disability, accident prevention, the use of nursing, nutrition, and social services, all call for their joint attention.

Cooperative efforts range from contractual agreements to informal but regular visits by field personnel of the licensing agency to the local health or welfare office for exchange of information. Joint action may include:

- Definition and approval of standards.
- Assignment of responsibility for various aspects of the inspection and licensing program.
- Development of an educational program for the participating agencies, their local opposite numbers, and for the operators of facilities.
- Exchange of information relating to the licensed facilities.
- Coordinated efforts, when necessary, for enforcement of the licensing law and regulations.

These activities may be based on law or they may grow out of contractual agreements. In some places, the policy of each agency specifies working with other agencies to meet the responsibilities assigned by law or custom to one or the other agency. Most commonly, however, these joint activities, as do so many others, rest on the authority of custom.

One of the successful statutory requirements for sharing responsibility in an institutional licensing program is found in Kansas. "Adult boarding homes," which include proprietary skilled nursing, personal care, and simple shelter facilities, are licensed by the State department of social welfare. The law calls for the participation of the State board of health and the State fire marshal as well as county health and welfare departments and the local fire and safety authorities. Child care facilities are licensed by the State board of health in conjunction with State and local agencies indicated above. In each area, teams jointly inspect the homes. Their visits are supplemented by calls by individual team members to help the home administrator.

In Sedgwick County, interdepartmental meetings have grown out of the licensing program. At these meetings, boarding home management and care of their residents, and child welfare and child care facilities are discussed.

Even in this apparently well-planned development, however, a recent study of the attitudes of public health nurses in the adult boarding home program reveals complaints of overlapping responsibilities, difficulties with representatives of other agencies, slights to professional prestige, and administrative failure to heed their professional judgments. Nevertheless, this joint program has improved and increased agency services to recipients of public assistance and has certainly increased the quantity of preventive health services made directly available to these recipients (17, 18).

In California, a tripartite agreement on standards and licensure responsibilities is observed by the State departments of public health, social welfare, and mental hygiene in regard to sheltered care for older people. The agreement results from a policy of working together to define the tasks that arise from responsibilities assigned by law to one or another department; to outline the knowledge, technical skills, and contacts of each department which could help the assigned agency to meet its obligation; and to agree on the use of all of the appropriate resources. Actually, joint conferences in this State preceded the writing of the law, to assist the legislature in preparing the requisite legislation. Such conferences are a regular feature of interagency relations in the California State Government. Mutual support of legislative programs and budget requests, based on understanding and an appreciation of common interests, is a natural outgrowth of this policy.

Oregon also offers interesting examples of interdepartmental institutional services. The State board of health licenses nursing homes and periodically circulates a list of licensed homes to the State and local welfare departments, a service that is by no means common, however elementary. The field staff of the licensing division visits the county welfare offices to learn what the staff knows about care in local nursing homes. This productive relationship, although found in a number of States, is often overlooked even in States with well-developed relationships in other areas.

The criteria for rates of payment to nursing homes were developed by the Oregon Public Welfare Commission with board of health con-

There are several examples of cooperative action relating to the rates of payment to hospitals and related facilities, such as the joint committees for nursing homes in Oregon and Maryland mentioned above. Rates paid by the New Hampshire Department of Public Welfare also are based on a classification of nursing homes by the State board of health.

In two States, interdepartmental committees representing the major purchasers of general hospital care have agreed upon methods of establishing hospital payment rates. In Illinois, such a committee has operated successfully for the past 11 years (196). There the State department of public health, the public aid commission, the division of services for crippled children of the University of Illinois, and the State division of vocational rehabilitation use the same Technical Advisory Committee on the Purchase of Hospital Care. Members are hospital administrators representing the Illinois Hospital Association who meet periodically with representatives of the four participating agencies to advise on a cost formula and payment agreements. The State department of public health provides staff, collects and analyzes the cost reports, certifies the cost figures, and classifies the hospitals. Each agency then agrees to pay hospitals on the basis of the certified costs.

In New York State, a similar plan is coordinated by a Hospital Rate Advisory Committee with representatives from health, welfare, education, mental hygiene, and the executive departments. The bureau of research and statistics of the department of social welfare makes the necessary statistical computations and certifies rates to each agency.

Rates paid to hospitals in Massachusetts by the department of public welfare are based on a formula and procedures for cost analysis worked out by the department of health and the State hospital association. In Virginia, the State department of health reviews and certifies hospital cost analysis for the department of welfare and institutions and the division of vocational rehabilitation and advises on hospital administration and licensure.

Interdepartmental services related to institutions appear to demonstrate the only clear-cut and consistent collaborative use of the skills

of State health and welfare departments. But their potential for improvement of institutional services to people has barely been tested. Nor have they been used sufficiently to bring the resources of the two agencies together to consider other areas of mutual concern.

### **Consultation Outside Institutions**

Consultation services are by no means restricted to the institutional setting. In the APHA study already mentioned, 123 local health departments (of 187 respondents) said that they provide consultation to the local welfare department. And 125 departments indicated that they receive consultative services from the welfare department. Only 34 health departments of 187 with some kind of active chronic disease program employ their own social workers. But another 123 departments use social work services obtained through some other agencies.

Asked whether the health department had knowledge of the welfare department policy on food expenditures, four health departments said that the information was not available from the local welfare department. Forty-one of the 187 health departments did not have the information.

In Quincy, Mass., on the other hand, the health department nutritionist has been an active participant in public welfare programs, assisting in training caseworkers and consulting on special diets. She has visited with caseworkers at homes where large families with small budgets need advice on food selection.

The bureau of nutrition of the New York State Department of Health, in addition to providing consultation to the State department of social welfare, has helped to bring together local public health nurses and caseworkers for education on food budgeting and nutrition. State nutritionists have also served as consultants to local interagency conferences of public health nurses, caseworkers, and casework supervisors concerned with specific families and their diet.

### **General Administrative Services**

The California rehabilitation project mentioned earlier (14) was designed not only to

Observations of the public assistance visitor and of physicians who treat public assistance clients are transmitted to the health department. The two State agencies have cooperated, when indicated, in revoking or refusing a license. This close cooperative arrangement has helped to improve the quality of care in the commercial and other nursing homes in the State (19a).

Local departments of health usually have limited relationships with State institutional licensing programs whether they be administered by the State health, welfare, or other agency. The local department may serve as a source for a sanitarian. On the other hand, county welfare departments are often prime sources of information on nursing homes and similar facilities, even when the State licensing program is administered by the health department. Unfortunately, there is rarely a two-way flow of information to enable the local agencies to know what recommendations have been made to institutions, what disciplinary action is pending, or which facilities are currently approved.

New York provides a notable exception to this generalization. Here the State department of social welfare administers the "approval" program for nursing homes and in addition some county health departments license these institutions. To help maintain the positive direction of these parallel accrediting programs, a working agreement has been developed between the respective authorities.

The report of a recent APHA study of the chronic disease activities of selected local health departments states that 72 departments (of 187 selected for study) license institutions caring for persons with long-term illness or disability. Seventy-one said that they participated with other community agencies in establishing standards of care in these institutions. Few indicated a solitary role in standard-setting. The report will be presented at the annual meeting of the American Public Health Association in November 1956.

### **Nutrition Consultation**

Nutrition consultation is a popular and useful institutional service which crosses depart-

mental lines (20). The APHA study reported that, of the departments selected, 70 offer such consultation to institutions caring for the chronically ill and disabled. Forty of these departments employ a professional nutritionist; the others presumably draw upon a State consultant or upon their public health nursing staff.

The Nassau County (New York) Health Department has a unique feature of teaching nutrition in a program directed generally at improvement of service in nursing homes. A local licensure provision assigns to the department responsibility for setting standards and licensing nursing homes. The consultant services of a nutritionist from the State department of public health are available to the local department and there has been some direct service to nursing homes from the State health department personnel. Medical consultation relating to diet is available within the county department. Results of the Nassau County program with respect to food practices, safety, and nursing care confirm the usefulness of this educational approach (21).

The Illinois Department of Public Health also maintains a nutrition consultation service in its licensing program (22). In Maryland and Wisconsin, nutrition consultation is offered not to institutions but to the welfare department staff concerned with standards and licensure for children's institutions.

### **Payment for Institutional Services**

Although public agencies have a growing responsibility for payment for institutional services, no one of the agencies is likely to have a staff adequate to ascertain that the public monies are well spent for institutional care. In many States, each agency purchases such services separately, with resulting annoyances and inequities to the institutions, and duplication of effort. It is an unfortunately common practice to pay higher rates for the care of bed patients than for patients who get out of bed with or without aid. (We do not recommend decreases in such payments. Rather, in view of the generally low and unrealistic rates of payment to nursing homes, we would call for the eventual application of the principle of payments based on the costs of care.)

joint planning. Joint committees on nutrition, aging, adoptions, mental health, rehabilitation, and nursing homes are among the usual ones. Council committees on housing, on determination of medical indigency, and on medical care for the needy are not uncommon in communities engaged in evaluation of health and welfare services.

In addition to their technical consultation services, health department representatives may serve on the advisory committees of the public welfare program and on the board itself to encourage a preventive approach in both health and welfare programs.

### Comparison of State and Local Relationships

Relationships between State health and welfare departments, whether established by law, contract, or verbal agreement, are more likely to be in the administrative area than in the area of direct service.

In local departments, direct service produces the greatest evidence of joint effort although, for the most part, cooperation is personal rather than official. This relationship could be broadened and made more effective by formal State and local policy.

### Conclusion

Five years ago, former Surgeon General Leonard Scheele (3), speaking to the American Public Welfare Association, said:

At any gathering of health or welfare people, the need for a cooperative attack upon interrelated problems is likely to be discussed. Public health people talked about it extensively at the recent American Public Health Association meetings in St. Louis. There is an equal eagerness among social workers. Yet, after the meetings are over, a cold, analytical look at actual operations in local communities and throughout the Nation shows that the "trend" toward cooperation is painfully slow. From the standpoint of structure for cooperative action, these organizations seem to be almost as far apart as they were in the days when welfare meant an occasional coal or grocery order and when public health meant a red placard on the home of a scarlet fever patient.

Although our current report describes patterns of cooperation among our State health and welfare agencies, Dr. Scheele's statement

of 5 years ago still applies. It is our impression that we have yet to reach the following four goals of joint activity:

1. Application of the normal program of the health department to the welfare population through active cooperation with welfare departments.

It may be necessary to modify or extend services within the range of knowledge, skills, and budget of the health department in order to meet the health needs of the welfare population. Meeting these needs may, of course, result in establishing an effective program of disease prevention.

Since ill health and disability rank so high among the causes of dependency, there is a moral responsibility and, in many instances, a legal responsibility to make health services available to the population in need.

The role of the welfare department in achieving the full application of the program of the health department to the welfare population requires active encouragement of welfare clients to use health services, especially preventive services. Welfare agencies do not hesitate to offer advice on a family budget or the food content of the diet possible within that budget. The relationship between client and agency offers an equally good opportunity for advice on when and how to use health services.

2. The development of appropriate health promotion and disease prevention activities in the welfare program itself.

A major responsibility of the health officer and his staff is to aid the welfare staff in identifying and developing areas in the welfare program which can serve to promote, protect, and restore the health and social usefulness of the people who come to the department for help.

First and probably most important is intake. Intake offers the ideal opportunity to determine the health status and needs of the potential client. This is the chance, usually neglected, to make preventive health services available as well as to establish a medical plan for the person and family in need.

Once the welfare department has accepted the client for service, the avenues toward health services are many and the guide is usually the caseworker. The achievement of health by the

extend the use of rehabilitation services but also to demonstrate the advantages of regular medical consultation to the public welfare program, and to call the attention of local departments to one of the ways of obtaining consultant services. A contractual agreement between the State departments of public health and social welfare calls for the full-time assignment of a medical officer to the welfare department.

New York State also offers examples of effective sharing of professional personnel. A health department nutrition consultant prepared a special diet manual for the department of social welfare and is available for other services. A dental consultant is detailed from the health department to provide services on a part-time basis. And, in an instance that is still unique, a deputy commissioner of health has been assigned to the department of social welfare full time as director of medical care. He has ready access to the resources of both departments, attends staff meetings of both organizations, and acts as interpreter of the programs of both agencies. The background of public health administration has made itself manifest in the medical care program for the needy, notably in rehabilitation services, in nursing home care, and in physicians' services.

The State department of social welfare has vigorously supported requests of the health department for social work staff. It has helped to draw up standards for such staff and has invited health department medical social workers to participate in semiannual meetings of its own medical social workers. The medical social service chief has provided orientation sessions on the welfare program to the public health nurses of the department of public health.

Many State agencies fail to provide staff orientation in programs of related agencies, not to mention their own. Everyone appears to agree on the need for such orientation and most ruefully admit there has not been time to carry out adequate orientation in their own program.

Among devices for achieving knowledge of programs of other agencies is the joint committee, such as the New York State Interdepartmental Health Resources Board with representatives from the departments of education, health, mental hygiene, correction, labor, and

social welfare; the Workmen's Compensation Board; and the Joint Hospital Survey and Planning Commission. Committees of the board provide a machinery for joint planning, coordination, and consultation. Other interdepartmental bodies, not part of the State interdepartmental health council but with health and welfare participation, include advisory committees to the department of mental hygiene and to the State Youth Commission.

None of these bodies is simply a paper representation. All have been concerned with planning and consultation and with joint studies and legislation. The State plan for chronic disease and rehabilitation facilities was thus jointly developed, as was also the rehabilitation program for adult public assistance recipients at the rehabilitation hospital operated by the State health department.

Local services and activities affecting administration of both health and welfare departments have been mentioned above under program titles, such as the use of joint staff conferences concerning patients with tuberculosis, child care, or for the definition of rehabilitation objectives for a patient. Such conferences for the solution of clinical problems play an important part in administration *per se*. They are, in themselves, manifestations of administrative policy. Case conferences serve also to bring people and agencies together, to understand one another and to exchange ideas and information. Often, the conference results in the definition or clarification of broad policy.

A meeting of the Suffolk County (New York) Health and Welfare Department staffs, about 2 years ago, showed how multiple demonstration case conferences in a workshop setting help achieve "more efficient interagency referral and communication systems" (23) and more direct contact among staff members. As a result, a joint committee was formed to interpret each agency's progress "and to develop further techniques for a better understanding of each agency's program," with consequent increase and improvement in referrals to both agencies.

Joint committees and active membership in community councils of social agencies are familiar methods of approaching common problems. They may be used also as the setting for

4. The development of the necessary policy and procedures to achieve improved health and welfare services without duplication when several agencies are involved.

Many functions of welfare departments touch those of the health department. And "touch" is often about as far as the relationship goes. This is true particularly when institutional inspection and licensure are assigned the welfare department and the health department is assigned responsibility for the sanitation inspection. This latter function rarely extends beyond the determination of technical compliance with the law and its regulations. The standards of nursing home care appear to have been markedly improved, however, in those States and counties where health and welfare department cooperation has been consciously organized. Crippled children's services, the tuberculosis control program, and rehabilitation services for adults likewise are improved where there are mutual responsibilities.

Examples of cooperative activities directed toward this goal range from organized referral procedures and a policy of using interagency case conferences to written contracts for the provision of specified services under stated conditions and to mutual study of long-range needs and support of legislation.

When these objectives of joint activity are reached, efficient operation will be assured, and the potential for better service, where responsibility overlaps, will be recognized. Each agency will be sensitive to the needs, and aware of the resources, lying outside of its own area of service.

To date, in the words of former Surgeon General Parran (24): "... In the tremendous problem of providing [health services] for the indigent, the social welfare agencies have taken the lead, largely because health departments have been unwilling or unable to accept this as a direct responsibility. The situation, however, is somewhat analogous to the relation of the health officer to the public water supply. He must know the needs for an adequate supply of potable water. He champions the provision of such a supply. He sees to it that the water plant is properly operated, even though this may be done by another branch of the city govern-

ment. This is the minimum responsibility which the health department should assume, both for the public water supply and for the public medical service needed by those unable otherwise to provide it. In fact, the health department should be instigator of and friend to all useful activities for the conservation of life and health. For if health officers do not recognize their responsibility, using all the methods given us by science, to organize community attacks upon the causes of ill health, the public health profession will revert to the ancient status of sanitary police, and other public medical agencies will be established to deal with the major health problems of today and tomorrow. We may be sure such problems will be dealt with."

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client, therefore, depends in large part upon the caseworker's alertness to the client's health needs and the worker's knowledge of the community's health resources. The welfare department needs the help of the health department in providing the orientation and knowledge necessary to create a high level of health interest among its staff. In our experience, welfare departments rarely call upon their health colleagues for such help.

Surely it is important for the caseworker who enters the client's home to be alert to the health status of the entire household; to try to ascertain what hazards to health arise out of the physical environment of the home and out of the social dynamics of the life within it. The translation of this knowledge into constructive family action implies health education, for which trained personnel of the health department should be able to offer knowledge, skills, and materials, as well as assistance through staff development programs in the welfare department.

In each of the categories of public assistance administered through the local welfare agency, there are opportunities for health department participation in identification of needs, in planning, in consultation, in the provision or coordination of services. Identifying and planning to meet rehabilitation needs of parents of recipients of aid to dependent children, tuberculosis screening for recipients of old age assistance, and consultation on problems among recipients of aid to the permanently and totally disabled are examples of services now provided in a few places by State and local public health departments.

As to general medical care, every welfare agency has one or more opportunities to tell its clients about services available and to encourage their intelligent use. There should also be opportunities to define the objectives of the medical care program to the providers of service and to assure that the program can function so as to achieve its objectives.

A positive approach to medical care, as distinguished from preoccupation with disease treatment, will emphasize prevention, early diagnosis, prompt treatment, and active rehabilitation. Such an approach will encourage appropriate use of the physician's services

rather than impress upon the client that "he must not seek the doctor's help unless he absolutely needs it." Health department representatives, serving among other members of a medical advisory committee, can help to develop and foster a positive approach to the medical care program.

In some instances, the health department's personnel and services may be all, or part, of the medical care program. Unfortunately, we have found that even when the health department is responsible for the general medical care program, a positive approach does not automatically ensue.

The current emphasis on extension of welfare department services beyond cash assistance implies a continuing increase in the health responsibilities of welfare agencies: services for unmarried mothers, for dependent and foster children, for the aged, and, in some communities, for families at large; and services directed at prevention of juvenile delinquency, control of alcoholism, or at the maintenance and improvement of standards of institutional care. In defining the objectives of these programs and in developing ways to attain their goals, welfare and health departments need to pool their knowledge. This is reason enough for getting together.

3. An increased awareness of the social and economic needs of persons coming to the attention of the health department and a clear understanding of the responsibilities, the potential activities, and the limitations of both agencies in support of people with such needs.

The welfare department has a right to expect that the health department is prepared to make referrals appropriate in content and time. Conversely, the health department has the right to expect appropriate referral for the services it offers. But this right is not fulfilled automatically. Public health nurses may have a hard time relinquishing part of their responsibility for patients, as caseworkers may for their clients. Successful referral programs provide administrative support and assurance through knowledge of personnel and operations, that the best interests of their patients or clients will be served by referral. Regular contact between the agencies concerned is needed to make this possible.



*Apparently real geographic variations in mortality from coronary heart disease occur in the United States. Further study of the populations with high death rates and those with low death rates may provide new clues concerning the factors responsible for this disease.*

# Geographic Patterns in Deaths From Coronary Heart Disease

By PHILIP E. ENTERLINE, M.A., and WILLIAM H. STEWART, M.D.

CONDITIONS for 1950 are more favorable to a study of deaths from coronary heart disease in the United States than for any prior period.

A complete population enumeration, which is important for the computation of death rates, is available for that year. Moreover, the sixth revision of the International Lists of Diseases and Causes of Death, which became effective in 1949, provided a single category (420) under which deaths from coronary arteriosclerosis were to be counted. Also, under the sixth revision of the International Lists, the Manual of Joint Causes of Death was abandoned, and the physician signing the medical certificate of death was given the responsibility for designating the underlying cause of death, the cause used in primary statistical tabulations. (There are a few exceptions to this general rule, but they are favorable to the counting of coronary

heart disease in primary tabulations.) According to the joint cause manual, if a death certificate carried the diagnoses of nephritis and acute coronary thrombosis, for example, it was counted as a death from nephritis. Under the sixth revision, if the attending physician states that the underlying cause of death is acute coronary thrombosis (coronary heart disease), the death is counted as a coronary heart disease death. (The term "coronary heart disease" as used here is synonymous with the International List term "arteriosclerotic heart disease.")

## Geographic Differences

The 1950 death rates for coronary heart disease in the United States present an interesting and thought-provoking geographic pattern, as shown in figure 1 for white males and in figure 2 for white females. The rates for each State and geographic division are given in table 1. These have been age adjusted by the direct method to the age distribution of the total population as enumerated in 1950. Also shown in table 1 are average death rates for the 3-year period 1949-51 for the age group 45-64. The geographic pattern of these rates is essentially the same as the pattern of age-adjusted rates for 1950. Deaths are those coded 420 in ac-

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*Mr. Enterline is chief statistician of the Heart Disease Control Program, Public Health Service, and Dr. Stewart is assistant director of the National Heart Institute, Public Health Service. This study was initiated while Dr. Stewart was chief of the Heart Disease Control Program.*

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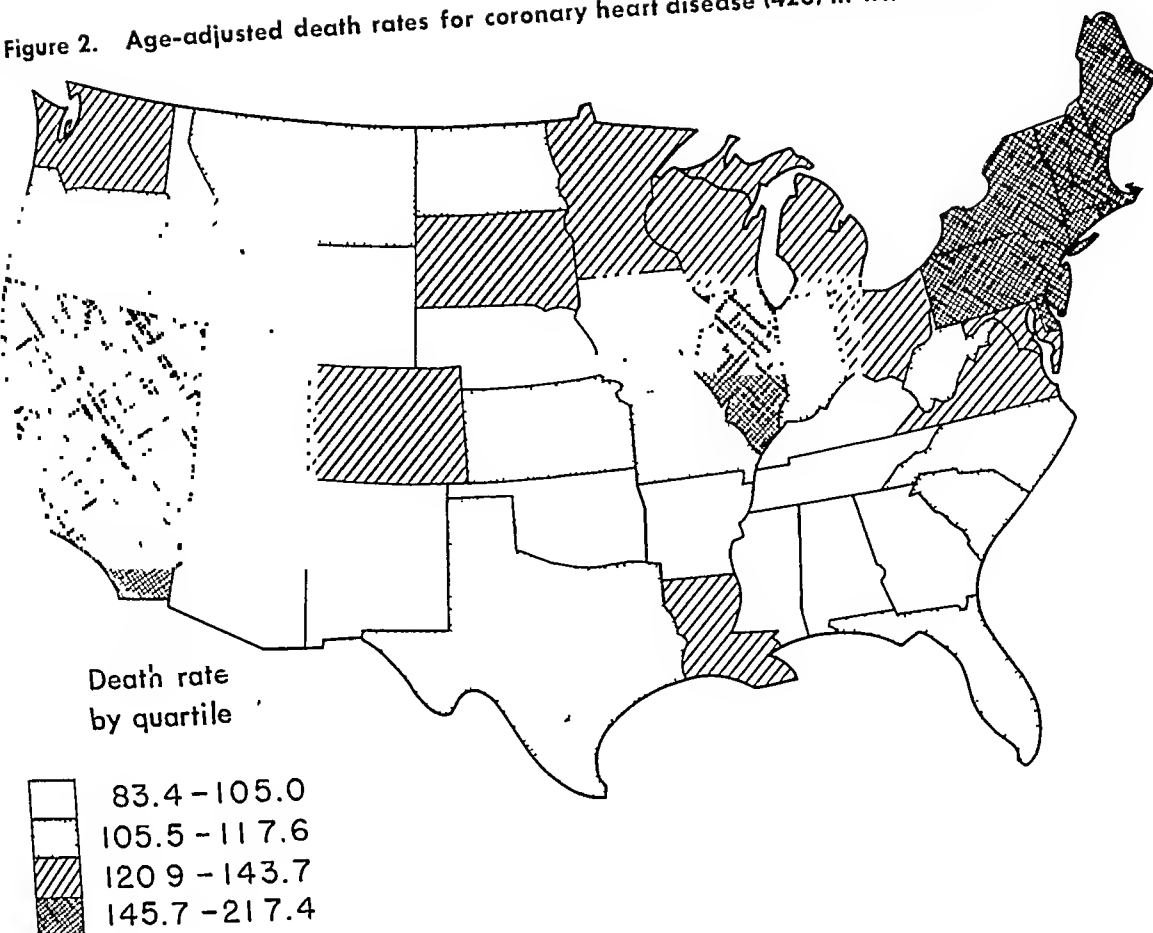
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Figure 2. Age-adjusted death rates for coronary heart disease (420) in white females, 1950.



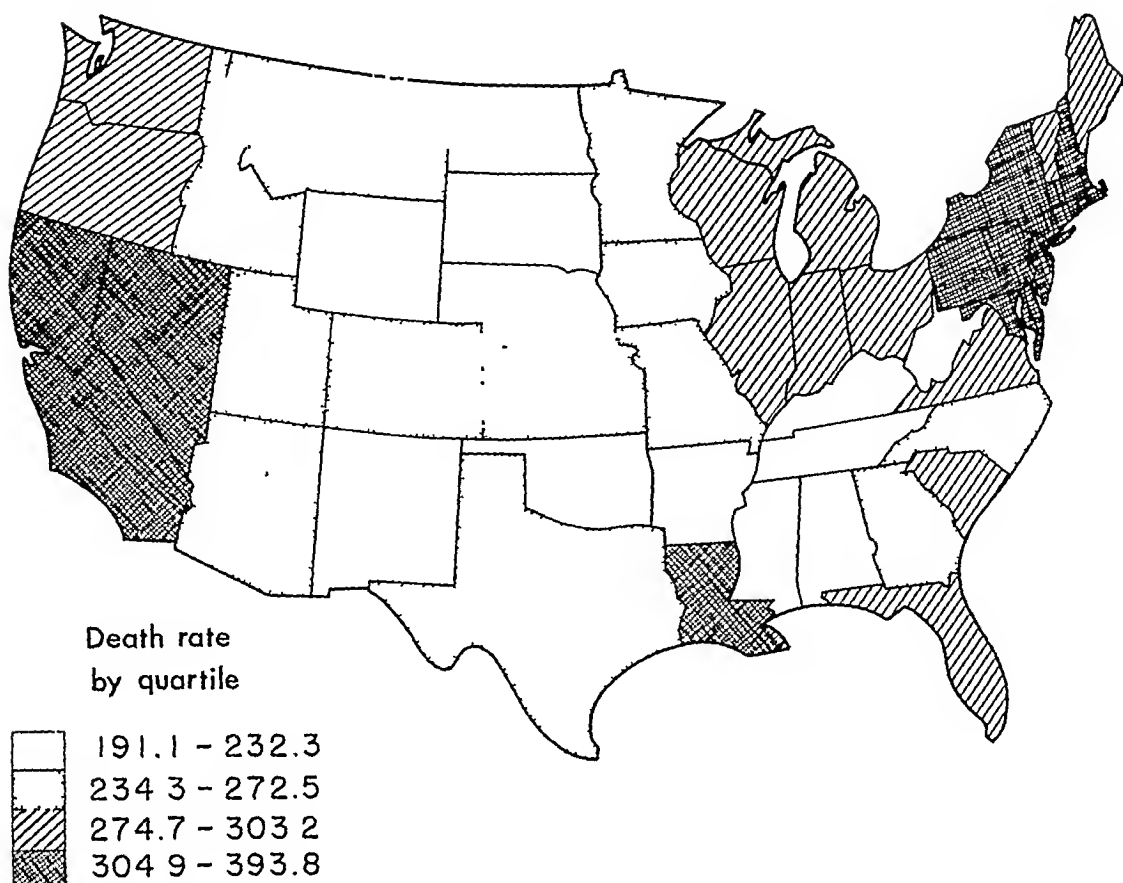
heart disease. It would be expected, therefore, that if real geographic differences in the death rates from coronary heart disease exist they would be reflected in differences in the death rates for all causes.

Data shown in table 3 for white males indicate that the coronary heart disease death rate does affect the death rate for all causes. Generally, in geographic divisions where the death rate for coronary heart disease is high, the death rate for all causes is high. This relationship is most striking in the age groups 55-64 and 65-74. In the age group 65-74 much of the variation in the death rates for all causes among geographic divisions is, in fact, eliminated when coronary heart disease deaths are excluded.

In the age group 75-84, there appear to be important differences in the diagnostic criteria used in the various geographic regions. This is suggested both by less association between the death rates for coronary heart disease and

the death rates for all causes in this age group as compared with other age groups and by a tendency for death rates for coronary heart disease to be negatively associated with death rates for all causes excluding coronary heart disease. It is probable that some deaths in the age group 75-84 called coronary heart disease in the Middle Atlantic States, for example, are called something else in the East South Central States. Diagnostic differences in the older age groups are to be expected in view of the increasing multiplicity of diseases present at time of death with increasing age, which makes identification of the underlying cause difficult. The numbers of deaths in the older age groups and the probable magnitude of the differences in diagnostic criteria are not sufficiently large, however, to account for an appreciable proportion of the geographic variation in the death rates shown in table 1.

Figure 1. Age-adjusted death rates for coronary heart disease (420) in white males, 1950.



cordance with the sixth revision of the International Lists, and they have been allocated to place of residence (1).

The death rate for coronary heart disease is roughly twice as high in some States as in others. In New Mexico, Arkansas, and Kentucky, the age-adjusted death rates among white males were 191.1, 201.2, and 211.2, respectively, as compared with death rates in New York, Rhode Island, and the District of Columbia of 393.8, 364.3, and 344.3. For white females the contrast is even greater, with death rates of 83.4, 87.8, and 89.0 in New Mexico, Arizona, and Nebraska, as compared with death rates of 217.4, 176.6, and 175.6 in New York, New Jersey, and Rhode Island. There is a definite tendency for States with similar death rates to cluster.

Because coronary heart disease has been recognized as an important clinical entity only since about 1920, it seems possible that dif-

ferences in the observed death rates among States might be due to differences in diagnostic criteria. There are, for example, differences in the amount of medical care available in various sections of the country which may in some way be associated with the likelihood of coronary disease being diagnosed at the time of death. Although the possibility that the observed differences are artificial can be tested only indirectly, the available evidence suggests that the differences in death rates in various parts of the country shown in figures 1 and 2 are real.

#### Effect on Deaths From All Causes

In the middle and older age groups, coronary heart disease deaths make up a large proportion of the deaths from all causes. As shown in table 2, about a third of all deaths among white males in the age group 45-74 are due to coronary

**Table 2. Number of deaths from all causes and from coronary heart disease and percentage due to coronary heart disease, white males and females, by age group, 1950**

Age group (years)	Deaths from all causes	Deaths from coronary heart disease	Percentage due to coronary heart disease
<i>Males</i>			
15-24.....	14,769	103	0.7
25-34.....	19,323	943	4.9
35-44.....	36,293	7,389	20.4
45-54.....	77,150	25,317	32.8
55-64.....	142,419	50,238	35.3
65-74.....	181,770	60,087	33.1
75-84.....	147,984	41,876	28.3
85 and over.....	48,249	11,213	23.2
<i>Females</i>			
15-24.....	7,024	72	1.0
25-34.....	12,235	278	2.3
35-44.....	22,915	1,283	5.6
45-54.....	42,994	5,244	12.2
55-64.....	79,803	16,497	20.7
65-74.....	130,712	33,813	25.9
75-84.....	141,519	35,066	24.8
85 and over.....	61,785	13,448	21.8

For white females the association between death rates for coronary heart disease and death rates for all causes is similar to that for white males; that is, in geographic divisions where the death rate for coronary heart disease is high, the death rate for all causes is high.

Table 4 shows a refinement of the data in table 3 for white males in the age group 55-64. Excluding deaths due to violence from deaths for all causes does not alter the association shown in table 3. The death rates for two disease categories (list Nos. 421-422 and 330-334) that might be confused with coronary heart disease either tend to be positively associated with the death rate for coronary heart disease or show no association at all. These data strongly support those shown in table 3 in favor of real and fairly large geographic differences in the death rate for coronary heart disease. Similar data for the other age groups likewise support this conclusion. Nevertheless, it is recognized that the differences may, to some extent, be influenced by differences in diagnostic criteria.

**Table 3. Death rates per 1,000 population for coronary heart disease, all causes, and all causes excluding coronary heart disease, white males in selected age groups by geographic division, 1950**

Geographic division <sup>1</sup> and age group	Coronary heart disease (420)	All causes	All causes excluding coronary heart disease	Geographic division <sup>1</sup> and age group	Coronary heart disease (420)	All causes	All causes excluding coronary heart disease
<i>Age group 45-54</i>				<i>Age group 65-74</i>			
Middle Atlantic.....	3.7	10.6	6.9	Middle Atlantic.....	19.6	54.0	34.4
Pacific.....	3.5	10.5	7.0	New England.....	18.2	50.6	32.4
New England.....	3.5	9.9	6.4	Pacific.....	17.5	48.2	30.7
East North Central.....	3.2	9.8	6.6	East North Central.....	15.7	49.1	33.4
South Atlantic.....	3.2	10.2	7.0	South Atlantic.....	14.3	47.8	33.5
West South Central.....	2.9	9.1	6.2	West North Central.....	13.8	44.1	30.3
West North Central.....	2.7	8.2	5.5	Mountain.....	13.7	45.5	31.8
Mountain.....	2.5	9.6	7.1	West South Central.....	13.4	43.4	30.0
East South Central.....	2.5	9.1	6.6	East South Central.....	11.6	44.6	33.0
<i>Age group 55-64</i>				<i>Age group 75-84</i>			
Middle Atlantic.....	9.4	25.5	16.1	Middle Atlantic.....	37.1	111.4	74.3
Pacific.....	9.1	23.4	14.3	New England.....	34.0	101.7	67.7
New England.....	8.9	23.5	14.6	Pacific.....	32.2	101.1	68.9
South Atlantic.....	8.0	23.6	15.6	East North Central.....	29.2	108.2	79.0
East North Central.....	7.9	23.3	15.4	West North Central.....	27.0	103.7	76.7
West South Central.....	6.9	20.9	14.0	Mountain.....	26.3	99.5	73.2
West North Central.....	6.8	19.4	12.6	South Atlantic.....	25.2	103.9	78.7
Mountain.....	6.4	20.9	14.5	West South Central.....	23.8	96.4	72.6
East South Central.....	6.2	20.6	14.4	East South Central.....	21.2	105.9	84.7

<sup>1</sup> Geographic divisions arrayed in order of magnitude of death rates per 100,000 population for coronary heart disease.

Table 1. Death rates per 100,000 population for coronary heart disease,<sup>1</sup> white males and females, by geographic division and State

Geographic division and State	Age-adjusted rates, 1950 <sup>2</sup>				Rates for age group 45-64; 3-year average 1949-51			
	Male		Female		Male		Female	
	Rate	Quartile <sup>3</sup>	Rate	Quartile <sup>3</sup>	Rate	Quartile <sup>3</sup>	Rate	Quartile <sup>3</sup>
New England	332.3		167.8		591.7		179.7	
Maine	280.6	3d	145.7	3d	533.4	3d	152.8	4th
New Hampshire	339.6	4th	159.7	4th	590.3	4th	155.2	4th
Vermont	303.2	3d	154.5	4th	559.4	3d	148.1	3d
Massachusetts	337.4	4th	171.0	4th	612.6	4th	188.0	4th
Rhode Island	364.3	4th	175.6	4th	613.4	4th	194.0	4th
Connecticut	339.9	4th	173.4	4th	565.6	3d	176.6	4th
Middle Atlantic	355.6		191.0		619.6		209.9	
New York	330.8	4th	217.4	4th	653.4	4th	223.2	4th
New Jersey	330.1	4th	176.6	4th	588.8	4th	194.3	4th
Pennsylvania	312.7	4th	159.3	4th	580.8	4th	196.7	4th
East North Central	290.5		137.7		535.2		150.8	
Ohio	289.1	3d	137.3	3d	541.3	3d	151.3	3d
Indiana	282.4	3d	117.4	2d	530.8	3d	136.0	3d
Illinois	293.4	3d	146.4	4th	545.2	3d	157.1	4th
Michigan	299.0	3d	135.6	3d	542.8	3d	154.1	4th
Wisconsin	282.5	3d	143.7	3d	488.9	2d	144.3	3d
West North Central	253.2		113.6		452.2		116.3	
Minnesota	272.5	2d	122.3	3d	457.8	2d	125.5	2d
Iowa	266.1	2d	121.3	3d	466.8	2d	119.7	2d
Missouri	246.4	2d	113.2	2d	458.6	2d	123.6	2d
North Dakota	232.3	1st	116.8	2d	374.3	1st	110.1	2d
South Dakota	232.1	1st	120.9	3d	438.2	2d	113.2	2d
Nebraska	221.3	1st	89.0	1st	435.3	1st	90.6	1st
Kansas	255.0	2d	105.6	2d	449.2	2d	102.2	1st
South Atlantic	270.2		118.4		520.1		131.3	
Delaware	330.7	4th	152.1	4th	546.9	3d	176.6	4th
Maryland	304.9	4th	137.9	3d	568.4	4th	146.7	3d
District of Columbia	344.3	4th	137.5	3d	613.1	4th	137.7	3d
Virginia	276.5	3d	122.7	3d	521.5	3d	134.7	3d
West Virginia	229.5	1st	113.2	2d	429.2	1st	137.4	3d
North Carolina	248.2	2d	107.2	2d	473.6	2d	117.7	2d
South Carolina	294.2	3d	108.8	2d	596.4	4th	137.7	3d
Georgia	247.9	2d	102.8	1st	477.2	2d	116.6	2d
Florida	274.7	3d	117.6	2d	569.5	4th	128.4	2d
East South Central	220.0		99.9		398.7		108.3	
Kentucky	211.2	1st	105.0	1st	380.5	1st	107.5	1st
Tennessee	217.4	1st	96.1	1st	385.6	1st	106.1	1st
Alabama	229.3	1st	101.3	1st	422.1	1st	114.5	2d
Mississippi	231.9	1st	92.2	1st	430.9	1st	105.2	1st
West South Central	246.0		106.2		459.5		107.9	
Arkansas	201.2	1st	90.5	1st	388.0	1st	92.7	1st
Louisiana	321.9	4th	138.0	3d	572.4	4th	149.3	3d
Oklahoma	222.3	1st	95.5	1st	436.6	2d	95.8	1st
Texas	247.0	2d	105.5	2d	453.2	2d	104.1	1st
Mountain	247.5		110.4		440.8		112.9	
Montana	250.9	2d	112.1	2d	494.5	3d	129.6	3d
Idaho	246.3	2d	99.4	1st	467.7	2d	106.7	1st
Wyoming	229.6	1st	90.8	1st	433.3	1st	90.4	1st
Colorado	258.5	2d	125.4	3d	446.4	2d	131.3	3d
New Mexico	191.1	1st	83.4	1st	309.0	1st	79.2	1st
Arizona	234.3	2d	87.8	1st	427.1	1st	89.8	1st
Utah	258.2	2d	113.8	2d	434.8	1st	118.5	2d
Nevada	333.4	4th	162.6	4th	569.6	4th	129.3	2d
Pacific	324.4		141.2		594.3		151.1	
Washington	292.8	3d	124.5	3d	539.2	3d	134.6	3d
Oregon	277.6	3d	109.8	2d	511.2	3d	120.6	2d
California	340.2	4th	149.1	4th	620.0	4th	159.0	4th

<sup>1</sup> International List No. 420.

<sup>2</sup> Direct method using total United States population in 1950; adjusted in 10-year age groups, under 5, 5-15

... 85 and over.

<sup>3</sup> Twelve States are in each quartile; the District of Columbia was assigned to the quartile in which it naturally fell.

**Table 5. Age-adjusted rates<sup>1</sup> per 1,000 population for coronary heart disease, 1950, and for diseases of the coronary arteries and myocardium, 1940, white males and females, by geographic division**

Geographic division <sup>2</sup>	Coronary heart disease (120), 1950	Diseases of the coronary arteries and myocardium (91a,b, 93a,b,d,e), 1940	
		All areas	Rural areas only
<i>Males</i>			
Middle Atlantic.....	3. 6	3. 6	3. 1
New England.....	3. 3	3. 2	2. 6
Pacific.....	3. 2	3. 1	2. 6
East North Central.....	2. 9	2. 7	2. 2
South Atlantic.....	2. 7	2. 4	1. 8
West North Central.....	2. 5	2. 1	1. 6
Mountain.....	2. 5	2. 2	1. 7
West South Central.....	2. 5	2. 0	1. 3
East South Central.....	2. 2	1. 8	1. 2
<i>Females</i>			
Middle Atlantic.....	1. 9	2. 4	2. 3
New England.....	1. 7	2. 2	1. 8
Pacific.....	1. 4	1. 7	1. 6
East North Central.....	1. 4	1. 9	1. 6
South Atlantic.....	1. 2	1. 5	1. 2
West North Central.....	1. 1	1. 3	1. 1
Mountain.....	1. 1	1. 4	1. 2
West South Central.....	1. 1	1. 2	. 9
East South Central.....	1. 0	1. 2	. 9

<sup>1</sup> Direct method, using 1950 population as standard for coronary heart disease, and 1940 population as standard for diseases of the coronary arteries and myocardium.

<sup>2</sup> Geographic divisions arrayed in order of the magnitude of the death rate per 100,000 population for coronary heart disease in 1950.

sponsible for differences in mortality from coronary heart disease. These theories might be investigated very profitably by studying intensively populations in those areas of the United States experiencing high death rates from coronary heart disease and populations in those areas experiencing low death rates from coronary heart disease.

## Summary

For 1950, the age-adjusted death rates for coronary heart disease for white males and white females were roughly twice as high in some States as in others.

The geographic differences are probably not due to differences in standards of diagnosis. However, studies to verify this would be desirable. In those age groups in which coronary heart disease is an important cause of death, the geographic differences in the coronary heart disease death rates are reflected in the death rates for all causes. Moreover, the death rates for two disease categories that might be used in lieu of coronary heart disease show no tendency to be negatively associated with the death rates for coronary heart disease.

The geographic differences do not seem to be due, to any large extent, to differences in urbanization in various parts of the country since they persist if rural areas are examined separately.

Whatever the factors responsible, they appear to affect males and females in about the same manner.

Some of the current theories as to the importance of various factors in the etiology of coronary heart disease might be investigated profitably by studying the populations in the areas of the United States with low and high death rates for this disease.

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Table 4. Death rates per 1,000 population for all causes (excluding violence), arteriosclerotic and degenerative heart disease, and strokes, white males aged 55-64, by geographic division 1950

Geographic division <sup>1</sup>	All causes excluding violence	Arteriosclerotic and degenerative heart disease and strokes				
		Total	Arteriosclerotic and degenerative heart disease			Strokes, list Nos. 330-334
			Total	List No. 420	List Nos. 421-422	
Middle Atlantic.....	24.1	12.3	10.6	9.4	1.2	1.7
New England.....	22.2	11.4	9.6	8.9	.7	1.8
South Atlantic.....	22.1	11.2	8.9	8.0	.9	2.3
East North Central.....	21.7	11.0	9.1	7.9	1.2	1.9
Pacific.....	21.5	11.5	9.8	9.1	.7	1.7
West South Central.....	19.4	9.3	7.5	6.9	.6	1.8
East South Central.....	19.1	9.2	7.0	6.2	.8	2.2
Mountain.....	18.9	8.7	7.2	6.4	.8	1.5
West North Central.....	17.9	9.1	7.4	6.8	.6	1.7

<sup>1</sup> Geographic divisions arrayed in order of magnitude of death rate per 100,000 population for all causes excluding violence.

### Possible Causes

It is productive to speculate as to possible causes for the apparently real geographic differences in mortality from coronary heart disease. One point of particular interest is the fact that whatever the causes are they appear to affect males and females in about the same manner. (There are, however, possibly meaningful differences in the ratio of white male to white female death rates; the ratio ranges from 1.8 in New York and 1.9 in New Jersey and South Dakota to 2.9 in South Carolina and Arizona.)

The most patent explanation for the geographic pattern seems to lie in an association between urbanization and mortality from coronary heart disease. It will be noted that areas of relatively high mortality in figures 1 and 2 tend to be highly urbanized. In support of this theory, Gover and Pennell reported that for 1940 the age-adjusted white death rates for diseases of the coronary arteries and of the myocardium were only about two-thirds as high in rural areas as in urban areas (2).

At this time, mortality tabulations which would permit an adjustment of the 1950 mortality rates for coronary heart disease for urbanization are not available. However, a comparison of the 1940 rates for diseases of the coro-

nary arteries and of the myocardium for urban and rural areas and for rural areas alone with the 1950 rates for coronary heart disease for each of the nine geographic divisions throws some light on the question. This comparison, shown in table 5, indicates that the same geographic pattern persists in rural areas as in the United States as a whole. (The same conclusion is reached if only diseases of the coronary arteries, list Nos. 94a and 94b, are used.) Although there were defects in the identification of coronary heart disease under the fifth revision of the International Lists, which was in effect in 1940, they probably do not invalidate the comparison. It would seem unlikely, therefore, that an adjustment of the 1950 data for urbanization would change greatly the geographic pattern shown in figures 1 and 2.

Most of the current theories which might explain geographic differences in coronary disease fall into two categories—genetic and cultural. With regard to the latter, many possibilities have been suggested, including such things as diet, exercise, and stress. All of these may play a part. There may also be hereditary factors which are manifested by differences in the physical characteristics of populations in various parts of the country (as well as in various parts of the world) and which are in some way re-



tories and rectal swabs for culture were obtained from them. Rectal swabs from the two food handlers in the school cafeteria and samples of the foods served during the preceding 2 days were also obtained for culture. The only food on the menu that could not be obtained was the potato salad served on September 21.

The parents of the school children were questioned on September 24, and data were obtained concerning the occurrence of illness, the time of onset, the clinical manifestations, and the history of foods consumed in the school cafeteria on September 21 and 22.

On September 25, *S. sonnei*, type 1, was isolated from 12 of the 18 original rectal swabs. Antibiotic sensitivity tests showed the organisms to be sensitive to aureomycin, terramycin, and chloramphenicol, but resistant to sulfadiazine and dihydrostreptomycin.

When the school reopened on September 27, all the children were questioned as to the occurrence of illness, the symptoms experienced, and the foods consumed. Rectal swabs were obtained from all the students and the staff.

Six weeks later, rectal swabs were again obtained from the students and staff, and families

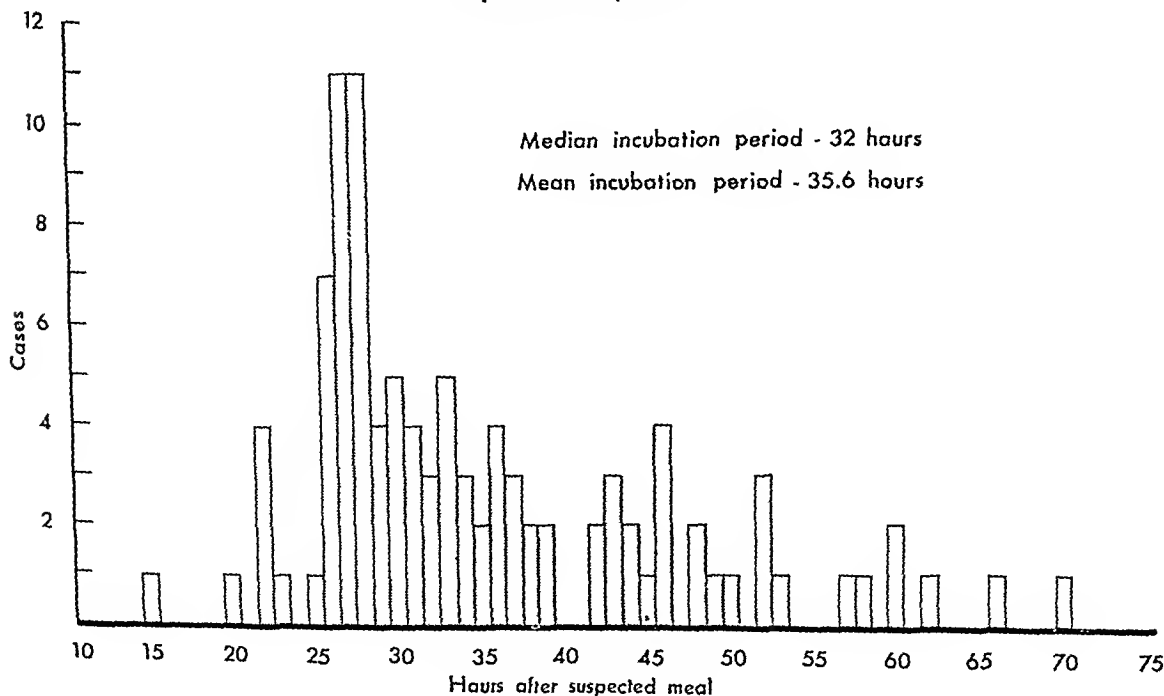
were questioned concerning the occurrence of subsequent illness among other members of the household. No fecal specimens were obtained from the household contacts.

### Laboratory Procedures

The fecal specimens were obtained by swabbing the walls of the anal canal with a sterile cotton swab. The soiled swab was placed in a tube containing a broth designed to act as a selective medium. Culture plates were streaked with the inoculated medium on the swab within 6 hours. The broth, which was prepared according to the formula of Hajna from the Bacto dehydrated product, is a medium in which gram-negative organisms are enriched and gram-positive organisms are inhibited (4). It has been shown by Croft and Miller to be particularly effective for the isolation of shigellae if the inoculated medium is kept no longer than 8 hours before streaking culture plates (5).

Colonies of non-lactose-fermenting bacteria from Endo and SS agar plates were transferred to triple sugar iron (TSI) agar slants. Those giving shigella reactions on TSI (alkaline slant,

Figure 1. Onset of clinical cases of gastroenteritis during the acute outbreak, September 22 through September 24, 1954.



# An Outbreak of *Shigella* Gastroenteritis

By MARTIN D. KELLER, M.D., Ph.D., and MALCOLM L. ROBBINS, M.D.

IN September 1954, an explosive outbreak of gastroenteritis occurred in a rural elementary school in central Ohio. Investigation by the division of communicable diseases of the Ohio Department of Health determined that the outbreak was related to food served in the school cafeteria. The etiological agent was found to be *Shigella sonnei*, type 1.

The American literature contains few well-documented reports of foodborne shigellosis. In 1950, Feig reviewed reports of outbreaks of diarrheal disease received by the Public Health Service from 1945 through 1947 (1). During this period there were 476 outbreaks characterized bacteriologically. Of these, only 14 were associated with *Shigella* organisms (only 3 with *S. sonnei*).

In surveys of normal population groups in the late 1930's and early 1940's, Watt and Hardy found the prevalence of shigellosis by culture to be 11 percent in New Mexico, 4 percent in Puerto Rico, 3 percent in Georgia, and 0.1 percent in New York City (2). In general, the infection rate was greatest in the 1- to 9-year

age group. In a study of clinical cases of diarrheal diseases, Hardy and Watt found that *S. sonnei* accounted for 20 to 25 percent of the shigella infections in New Mexico and in Georgia and for 57 percent in New York City (3).

## Investigation of the Outbreak

The first illness in the Ohio outbreak occurred at 3 a. m. on September 22, 1954, and the majority of the cases began during the afternoon and night of the same day. Through inquiry among local physicians and at nearby schools, it was determined that the illness was limited to the children and teachers of one elementary school.

The illness was characterized by fever, chills, headache, abdominal pain, nausea, vomiting, diarrhea, and prostration. In most cases, the temperature (oral) ranged from 100° to 105° F. Several cases began with convulsions. The illness usually lasted from 24 to 72 hours, and severe symptoms rarely persisted longer than 24 hours. None of the patients were hospitalized. About one-third of them were seen by physicians. The drugs most frequently used were neomycin, sulfadiazine, kaopectate, and paregoric.

The school was closed before noon on September 23 because of marked absenteeism, and it remained closed until September 27. The school population consisted of 268 children and a staff of 12. On September 23, visits were made to some of the homes in the community to locate sick children. Eighteen acutely ill children were discovered in this manner, and his-

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*Dr. Keller and Dr. Robbins, at the time of this study, were officers of the Epidemic Intelligence Service, Communicable Disease Center, Public Health Service, on assignment to the division of communicable diseases, Ohio Department of Health. Dr. Keller is now assistant resident in medicine at the Bronx Veterans Administration Hospital, New York City, and Dr. Robbins was scheduled to become senior resident in pediatrics at the Bronx Municipal Hospital Center on July 1, 1956.*

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evidence of infection (clinical illness or positive culture, or both) for the same two categories. These rates offered statistically significant evidence that infection was related to consumption of the suspected meal.

Table 3 shows that for both those who ate the suspected meal and those who did not eat it the rate of clinical illness was nearly as high as the attack rate based on evidence of infection. These findings differ from the expected ratio of clinical cases to carriers.

From table 4, it can be seen that the positive culture rates were substantially lower than the infection rates. However, on the basis of one culture, the rate for those who ate the suspected meal represents a rather high percentage of isolation of *S. sonnei* from an exposed population.

**Table 5. Positive culture rate related to clinical illness**

Illness status	Positive culture	Negative culture	Total	Positive culture rate (percent)
Ill.....	92	59	151	61.0
Not ill.....	15	75	90	16.6
Total.....	107	134	241	44.4

Table 5 shows that positive cultures were found in 61.0 percent of the persons who were ill, but in only 16.6 percent of those who were not ill.

Table 6, which gives data for 237 of the school children, reveals that there were no statistically significant differences in infection rate for the various ages.

Detailed descriptions of symptoms were obtained for 122 of the persons who were ill. The following symptoms were reported most frequently: diarrhea, for 103 persons (84 percent); fever, for 83 (68 percent); and vomiting, for 49 (40 percent).

Information concerning the specific foods eaten for lunch on September 21 and 22 was considered to be unreliable because of the age of the patients and the general imperfections of memory. Nearly all the students ate some of all of the foods served, as is the custom in school cafeterias.

**Table 6. Infection rate according to age**

Age, in years	Infected <sup>1</sup>	No evidence of infection	Total	Infection rate (percent)
5.....	1	1	2	50.0
6.....	21	9	30	70.0
7.....	22	11	33	66.7
8.....	18	10	28	64.3
9.....	8	13	21	38.1
10.....	17	7	24	70.8
11.....	28	6	34	82.4
12.....	24	10	34	70.6
13.....	15	4	19	78.9
14.....	5	4	9	58.3
15.....	1	1	2	
16.....	1	0	1	

<sup>1</sup> Clinical illness or positive culture, or both.

Six weeks after the onset of the first illness, rectal swabs were obtained from 234 of the students and staff members of the school. Only 5 cultures positive for *S. sonnei*, type 1, were found, and of these, only 3 were for persons who 6 weeks earlier had a positive culture. For all 5, 2 consecutive negative cultures were obtained during the following 2 weeks.

Information concerning subsequent cases of gastroenteritis in household contacts was obtained from 81 families 6 weeks after the outbreak. In these families there were 109 children infected during the initial outbreak and 293 household contacts. Twenty-eight of the household contacts were infected, a secondary attack rate of 9.5 percent. The dates of onset of illness and the distribution among preschool children, school children, and adults are shown in figure 2. Illness in household members with no exposure to the source of the infection was considered a secondary infection even though it occurred on the last day of the outbreak.

## Discussion

The school lunch of September 21 was considered the common, single source of infection in this outbreak of shigellosis because of its relation to the time of onset of the cases. If the lunch of September 20 were the source, the first case would have had an incubation period of 39 hours and the median of the incubation periods would have been 56 hours. The lunch of September 23 is eliminated because at least seven

acid butt, and negative H<sub>2</sub>S) were tested with shigella group serums. After the causative organism was identified as *S. sonnei*, type 1, only the specific antiserum was used in the slide test for identifying suspected cultures.

The isolated organisms were tested for antibiotic sensitivity by the Difco disk method.

**Table 1. Illness and culture data related to consumption of suspected meal**

Consumption of suspected meal	Ill		Not ill		Total
	Positive culture	Negative culture	Positive culture	Negative culture	
Ate.....	92	56	13	46	207
Did not eat..	0	3	2	29	34
Total....	92	59	15	75	241

**Table 2. Infection rate related to consumption of suspected meal**

Consumption of suspected meal	Infected <sup>1</sup>	No evidence of infection	Total	Infection rate (percent)
Ate.....	161	46	207	77.8
Did not eat..	5	29	34	14.7
Total.....	166	75	241	68.9

<sup>1</sup> Clinical illness or positive culture, or both.

The food samples were homogenized or diluted and streaked on culture plates. Staphylococcus 110 medium was employed for the isolation of staphylococci, and Endo agar, for the isolation of salmonellae and shigellae. No pathogenic organisms were found.

Bacteriological examination of water samples taken from the school gave negative results for coliform organisms.

## Results

The time of onset of illness was learned for 104 of the 151 persons who were ill. The epidemic curve is given in figure 1. After the first case, the curve showed a rapid rise, reaching a peak in approximately 12 to 13 hours. The occurrence of cases then fell off gradually, the final

case appearing 55 hours after the first. The epidemic curve indicates a single source, single exposure epidemic, and it appears that the incriminated meal was the lunch of September 21. This lunch would give an incubation period ranging from 15 to 70 hours, with a mean of 35.6 hours and a median of 32 hours. Feig reported a median of 42 hours in 6 outbreaks of shigellosis (1).

Information on the following was obtained for 241 of the 280 students and staff members: consumption of the suspected meal, occurrence of illness, and results of rectal culture. Illness was defined as the presence of two or more of the following: fever, abdominal pain, nausea, vomiting, and diarrhea.

Only the data for these 241 persons are given in tables 1 through 5. However, partial data were obtained for an additional 32 persons, 20 of whom showed evidence of infection either by illness or by positive fecal culture. No information was obtained for seven of the school population.

The number of persons ill and the number of positive fecal cultures among persons who ate the suspected meal and those who did not eat it are shown in table 1.

Table 2 compares the attack rates based on

**Table 3. Clinical illness rate related to consumption of suspected meal**

Consumption of suspected meal	Ill	Not ill	Total	Illness rate (percent)
Ate.....	148	59	207	71.5
Did not eat..	3	31	34	8.8
Total.....	151	90	241	62.6

**Table 4. Positive culture rate related to consumption of suspected meal**

Consumption of suspected meal	Positive culture	Negative culture	Total	Positive culture rate (percent)
Ate.....	105	102	207	50.7
Did not eat..	2	32	34	5.9
Total.....	107	134	241	44.4

sided, but the duration of infection after recovery was only 32 days for *S. flexneri* and only 22 days for *S. sonnei*. These investigators felt that the chronic carrier was exceptional in bacillary dysentery and that the organism is more frequently perpetuated in the community by a constantly changing group of hosts.

Cruikshank and Swyer studied an outbreak of 32 cases of shigellosis in a residential school (8). Twenty-nine gave positive cultures initially, and the number of positive cultures decreased slowly until only one was found in the 10th week. However, 10 patients, 34.4 percent of the group, had 2 or more consecutive negative cultures followed by 1 or more positive cultures, and 5 patients had 3 or more consecutive negative specimens over a period of 3 weeks, only to yield positive cultures again. These findings indicate that the data obtained in the present study from one initial culture and one followup culture after a period of 6 weeks can give only a rough estimate of the extent of the original infection and the persistence of the infection in the group. However, the figures obtained by this method are in keeping with those found by other workers.

The Ohio outbreak appears to have been quite different from an outbreak of shigellosis in Oxford, England, reported by Davies (9). In the Oxford outbreak, the first case occurred in a school for infants, but the spread of infection seemed to be mainly in the homes. Of 74 primary cases, 47 occurred in the original school and 27 in 10 other schools. Among the 293 home contacts of these 74 cases, 234 of whom had at least one stool examination, 16.3 percent had clinical illness and 33.3 percent had positive cultures but no clinical illness. In the Ohio epidemic, the school was the immediate source of infection for 81 families. In these families, 109 children were infected during the initial outbreak, and only 28 cases of gastroenteritis were reported among their 293 household contacts. Since no fecal specimens were obtained from the household contacts, the subsequent cases can only be presumed to be related to the initial outbreak. However, it is probable that considerably more persons in these families became infected but did not have clinical illness.

The clinical manifestations observed in the

Ohio outbreak were similar to those described by Blatt and Shaw (10) and Cruickshank and Swyer (8).

Zimmerman, Cooper, and Graber studied an epidemic of shigella infection in Korea in 1952 (11). They found sulfadiazine therapy unsatisfactory. Chloramphenicol, terramycin, and aureomycin were found to be highly effective, and streptomycin was intermediate. All 13 types of shigellae that they isolated were found to be highly sensitive to chloramphenicol, terramycin, and aureomycin, but not sensitive to sulfadiazine and dihydrostreptomycin. In recent years, few sulfadiazine-sensitive shigellae have been isolated by the Ohio Department of Health laboratories.

Thus, the expense of treating shigella infections poses a special problem. In massive outbreaks in rural areas, where income may be low, it is often not possible to treat all patients with the most effective antibiotics. However, in the outbreaks described in this paper, all those who were ill recovered without apparent complications within a period of a few days, despite the fact that very few were given antibiotic therapy.

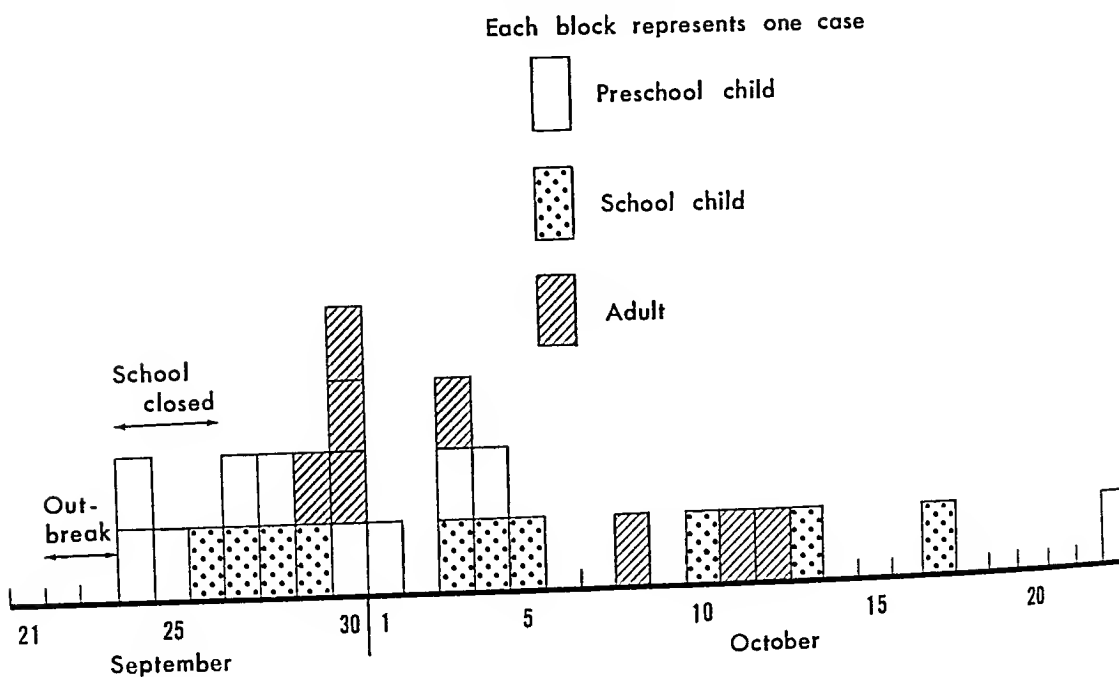
### Summary

An outbreak of gastroenteritis in a rural elementary school in central Ohio in September 1954 is described. From data collected concerning occurrence of illness, time of onset, consumption of a suspected meal, and results of fecal cultures, it appeared that the outbreak followed a mass exposure to *Shigella sonnei* at a school lunch.

The first illness occurred 15 hours after the suspected meal. After this, the number of cases increased rapidly, and the peak of the outbreak occurred 27 to 28 hours after the meal. The median of the incubation periods was 32 hours, and the range was from 15 to 70 hours.

For 241 of the 280 students and staff members of the school, the following findings were obtained: Of those who ate the suspected meal, 71.5 percent became ill; of those who did not eat this meal, only 8.8 percent. From one fecal specimen taken within 8 days of the beginning of the outbreak, *S. sonnei*, type 1, was isolated

Figure 2. Occurrence of secondary cases in household contacts of persons infected during the acute outbreak.



cases had their onset before the lunch was served.

Neither of the two food handlers was ill, but both had cultures positive for *S. sonnei*, type 1. It is possible that they became infected in the same manner as did the rest of the school population. However, it is conceivable that one of them carried the organisms before the outbreak occurred and contaminated the foodstuffs served at the lunch on September 21.

The last contact the children had with one another in school during the outbreak was on the morning of September 23, approximately 46 hours after the lunch on September 21. There is a possibility that some of the late cases were secondarily infected from the early ones. However, it is reasonable to explain the epidemic curve on the basis of a single source and a single exposure.

The attack rate of 77.8 percent, based on the occurrence of illness or the finding of *S. sonnei*, type 1, or both, points to massive exposure of the population of the school. However, 39 percent of those who were ill had negative cultures, and 16.6 percent of those who had no clinical illness were shown to be asymptomatic carriers. It is reasonable to suppose that a considerable

number of asymptomatic carriers were missed since only one culture was obtained during the outbreak for each person.

Watt and Hardy found that infection without clinical disease was rare in infants, but that it progressively increased up to the age of 5 years (2). Thereafter, it occurred at a fairly uniform rate. For all age groups, the ratio of convalescent or passive carriers to each current case was 9.1. They also found that the ratios were fairly uniform for different types of shigellae. They concluded that manifest sources of infection are rare in comparison to hidden sources. In a study of shigella infection in a closed institutional population, Hardy, Shapiro, Chant, and Siegel found that the ratio of carriers to clinical cases was greater for *S. sonnei*, 24:1, than for *Shigella flexneri*, 7:1, (6).

In the present study, only 5 persons had positive cultures 6 weeks after the initial outbreak, and these became negative on at least 2 subsequent samples within the next 2 weeks. These findings are in keeping with the findings of Watt, Hardy, and DeCapito (7). Of 103 patients with proved shigellosis, 80 percent had positive cultures after the acute symptoms sub-

# Survey of General Hospitals Accepting Mental Patients

By BERNARD H. KROLL, B.A., and HYMAN GOLDSTEIN, Ph.D.

DURING the period from December 1951 to May 1953, the National Institute of Mental Health of the Public Health Service conducted a survey of the general hospitals in the United States. The original purpose of the survey was to ascertain which general hospitals accepted as inpatients persons with a primary diagnosis of suspected or actual mental illness in order to bring up to date the number of general hospitals to be included in the census of mental patients. As a result of the survey, the number of hospitals included in the census of mental patients rose to 546 compared with 157 prior to the survey.

Data were also collected on type of patient accepted, hospital size, and the types of therapy available for each hospital offering therapy. It is believed that presentation of data on the types of therapy available at the time of the survey would be useful since such data would serve as a baseline for future studies of the types of therapies available in general hospitals. This is particularly so in the light of the more recent developments in drug therapy, such as the use of reserpine, chlorpromazine, and other tranquilizing drugs, the growth of

general hospital facilities for the mentally ill, and the increasing development of nonhospital treatment for the mentally ill.

Some background on the distribution in the States of the hospitals reporting and those indicating acceptance of mental patients is presented in table 1. Additional tabulations showing in greater detail the distribution of these hospitals are available (see documentation note). Of the 4,716 hospitals surveyed, 4,702, or 99.7 percent, of the hospitals queried reported. Reporting was 100 percent complete for 40 States and the District of Columbia. About 40 percent of the reporting hospitals had average daily resident populations of 50 or more. About 21 percent of the hospitals with average daily resident patient populations of 50 or more accepted mental patients as contrasted to about 6 percent of the hospitals with average daily resident patient populations under 50. It is clear that there is a significant difference in the acceptance of mental patients between hospitals with average censuses of 50 or more and those under 50.

The types of patients accepted by the 546 hospitals reporting the acceptance of mentally ill patients and the type of service offered are shown in table 2. Of these 546 general hospitals, 176, or 32.2 percent, routinely offer only diagnostic workup for patients admitted. This does not imply that occasional treatment may not be given for a selected patient, but it does mean that the hospital acts as a diagnostic and screening center, and patients who are in need

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*Mr. Kroll is an analytical statistician, Hospital Reports and Records Unit, and Dr. Goldstein is chief, Current Reports Section of the Biometrics Branch, National Institute of Mental Health, National Institutes of Health, Public Health Service.*

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from 50.7 percent of those who ate the suspected meal but from only 5.9 percent of those who did not eat it. Considering those persons who were ill or who had a positive fecal culture, the attack rate for all was 77.8 percent. Of the persons who were ill, 61 percent had positive fecal cultures; of those who were not ill, only 16.6 percent were positive.

Two food handlers gave positive fecal cultures, but they had no clinical illness. No specific food was implicated.

Six weeks after the occurrence of the first case, when 234 fecal specimens were taken, only 5 contained *S. sonnei*, type 1.

Among 293 household contacts of 109 infected children, in 81 families, only 28 (9.5 percent) became ill with gastroenteritis within 6 weeks after the outbreak. Of these, 20 were children under 15 years of age.

Other reports of shigella infection are discussed briefly and compared with the Ohio outbreak.

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## Traineeships for Public Health Personnel

Authorized by the Health Amendments Act of 1956 (P. L. 911), the Public Health Service has appropriated \$1 million to establish a program of traineeships for graduate or specialized public health training of professional public health personnel for the fiscal year ending June 30, 1957.

The funds will include necessary costs, such as living expenses, tuition, and travel, as determined by the Surgeon General. All professional public health personnel are eligible.

Information and application forms may be obtained from any of the regional offices of the Public Health Service, or from the Chief, Division of General Health Services, Bureau of State Services, Public Health Service, Washington 25, D. C.



# Survey of General Hospitals Accepting Mental Patients

By BERNARD H. KROLL, B.A., and HYMAN GOLDSTEIN, Ph.D.

**D**URING the period from December 1951 to May 1953, the National Institute of Mental Health of the Public Health Service conducted a survey of the general hospitals in the United States. The original purpose of the survey was to ascertain which general hospitals accepted as inpatients persons with a primary diagnosis of suspected or actual mental illness in order to bring up to date the number of general hospitals to be included in the census of mental patients. As a result of the survey, the number of hospitals included in the census of mental patients rose to 546 compared with 157 prior to the survey.

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general hospital facilities for the mentally ill, and the increasing development of nonhospital treatment for the mentally ill.

Some background on the distribution in the States of the hospitals reporting and those indicating acceptance of mental patients is presented in table 1. Additional tabulations showing in greater detail the distribution of these hospitals are available (see documentation note). Of the 4,716 hospitals surveyed, 4,702, or 99.7 percent, of the hospitals queried reported. Reporting was 100 percent complete for 40 States and the District of Columbia. About 40 percent of the reporting hospitals had average daily resident populations of 50 or more. About 21 percent of the hospitals with average daily resident patient populations of 50 or more accepted mental patients as contrasted to about 6 percent of the hospitals with average daily resident patient populations under 50. It is clear that there is a significant difference in the acceptance of mental patients between hospitals with average censuses of 50 or more and those under 50.

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**Table 1. Replies received in the survey of general hospitals, by average daily resident patient populations: United States and each State, 1952**

United States and each State	All hospitals	Hospitals with average daily resident patient populations					
		50 and over			Under 50		
		Total	Accepting mentally ill	Not accepting mentally ill	Total	Accepting mentally ill	Not accepting mentally ill
United States.....	14,702	1,858	386	1,472	2,844	160	2,684
Alabama.....	89	25	6	19	64	3	61
Arizona.....	40	12	3	9	28	2	26
Arkansas.....	64	13		13	51		51
California.....	254	118	25	93	136	4	132
Colorado.....	68	19	4	15	49	1	48
Connecticut.....	38	30	4	26	8	1	7
Delaware.....	10	9	1	8	1		1
District of Columbia.....	13	10	4	6	3	1	2
Florida.....	101	32	6	26	69	3	66
Georgia.....	102	23	5	18	79	6	73
Idaho.....	47	7	2	5	40	3	37
Illinois.....	219	127	21	106	92	7	85
Indiana.....	104	47	16	31	57	6	51
Iowa.....	112	41	11	30	71	3	68
Kansas.....	115	31	10	21	84	4	80
Kentucky.....	82	27	8	19	55	2	53
Louisiana.....	103	26	6	20	77		77
Maine.....	43	10	2	8	33	1	32
Maryland.....	41	27	1	26	14	1	13
Massachusetts.....	128	76	17	59	52	1	51
Michigan.....	176	75	13	62	101	5	96
Minnesota.....	163	47	14	33	116	11	105
Mississippi.....	85	11	1	10	74	6	68
Missouri.....	107	48	15	33	59	5	54
Montana.....	46	10	3	7	36	3	33
Nebraska.....	94	20	7	13	74	4	70
Nevada.....	14	2	1	1	12		12
New Hampshire.....	32	14	3	11	18	1	17
New Jersey.....	90	60	11	49	30	1	29
New Mexico.....	30	4		4	26	1	25
New York.....	301	197	29	168	104	6	98
North Carolina.....	129	49	5	44	80	3	77
North Dakota.....	39	14	5	9	25	2	23
Ohio.....	158	101	14	87	57	2	55
Oklahoma.....	95	15	3	12	80	4	76
Oregon.....	61	16	2	14	45	3	42
Pennsylvania.....	222	161	31	130	61	3	58
Rhode Island.....	12	8	2	6	4		1
South Carolina.....	58	21	6	15	37	1	36
South Dakota.....	44	9	4	5	35	1	34
Tennessee.....	91	19	4	15	72	3	69
Texas.....	435	60	19	41	375	23	352
Utah.....	25	8	5	3	17		17
Vermont.....	22	8	5	3	14		14
Virginia.....	76	37	5	32	39	6	33
Washington.....	96	36	10	26	60	3	57
West Virginia.....	65	35	4	31	30	2	28
Wisconsin.....	136	58	11	47	78	12	66
Wyoming.....	27	5	2	3	22		22

<sup>1</sup> The 14 hospitals not reporting were in the following States: 1 each in Arkansas, Massachusetts, New York, Tennessee, and Washington; 2 hospitals each in Florida and Georgia; and 5 hospitals in California.

Table 2. Number of hospitals accepting mental patients, by type of patient accepted and services offered: United States and each State, 1952

United States and each State	All hospitals			Hospitals accepting					
				Psychotics and others			Nonpsychotics only		
	Total	Diagnostic workup only	Diagnosis and treatment	Total	Diagnostic workup only	Diagnosis and treatment	Total	Diagnostic workup only	Diagnosis and treatment
United States.....	546	174	372	445	136	309	101	38	63
Alabama.....	9	3	6	7	2	5	2	1	1
Arizona.....	5	2	3	4	2	2	1	1	1
Arkansas.....	29	17	12	27	16	11	2	1	1
California.....	5	1	4	5	1	4	1	1	1
Colorado.....	5	1	5	5	1	5	1	1	1
Connecticut.....	1	1	1	1	1	1	1	1	1
Delaware.....	1	1	1	1	1	1	1	1	1
District of Columbia.....	5	1	4	4	1	3	1	1	1
Florida.....	9	2	7	8	2	6	2	1	1
Georgia.....	11	3	8	9	2	7	2	1	1
Idaho.....	5	3	2	3	2	1	7	2	5
Illinois.....	28	5	23	21	3	18	1	1	1
Indiana.....	22	8	14	21	8	13	3	2	1
Iowa.....	14	6	8	11	4	7	3	2	1
Kansas.....	14	2	12	13	2	11	1	2	1
Kentucky.....	10	4	6	7	2	5	3	1	1
Louisiana.....	6	1	5	5	1	4	1	1	1
Maine.....	3	3	1	2	2	1	1	1	1
Maryland.....	2	2	2	1	2	1	7	2	5
Massachusetts.....	18	4	14	11	7	9	2	1	1
Michigan.....	18	8	10	16	7	9	2	1	2
Minnesota.....	25	8	17	23	8	15	2	1	2
Mississippi.....	7	5	2	6	4	2	1	2	2
Missouri.....	20	4	16	16	2	14	4	1	1
Montana.....	6	4	2	6	4	2	2	1	1
Nebraska.....	11	2	9	9	1	8	2	1	1
Nevada.....	1	1	1	1	1	1	3	1	2
New Hampshire.....	4	2	2	1	1	1	1	1	1
New Jersey.....	12	5	7	11	5	6	1	1	1
New Mexico.....	1	1	1	1	1	1	8	2	6
New York.....	35	12	23	27	10	17	3	1	1
North Carolina.....	8	4	4	7	4	3	1	1	1
North Dakota.....	7	5	2	6	4	2	1	1	1
Ohio.....	16	1	15	15	1	14	3	1	2
Oklahoma.....	7	2	5	4	1	3	1	1	1
Oregon.....	5	3	2	4	2	2	1	1	8
Pennsylvania.....	34	4	30	25	3	22	9	1	1
Rhode Island.....	2	2	2	2	1	1	1	1	1
South Carolina.....	7	1	6	6	3	3	1	1	1
South Dakota.....	5	4	1	4	1	3	1	1	6
Tennessee.....	7	7	7	7	7	7	9	3	1
Texas.....	42	10	32	33	7	26	5	1	1
Utah.....	5	2	3	5	2	3	3	1	1
Vermont.....	5	4	7	9	3	6	2	2	1
Virginia.....	11	6	7	11	4	7	5	2	3
Washington.....	13	3	13	18	7	11	5	3	2
West Virginia.....	6	3	3	1	1	1	1	1	1
Wisconsin.....	23	10	13	2	2	2	2	2	2
Wyoming.....	2	1	1	1	1	1	1	1	1

**Table 3. Number of hospitals accepting mental patients and offering treatment, by type of treatment offered: United States and each State, 1952**

United States and each State	All hospitals <sup>1</sup>	Psychotherapy	Insulin	Electrotherapy	Metrazol or other shock	Psychosurgery	Drug	Fever	Occupational	Physiotherapy	All other
United States.....	372	305	237	274	68	124	264	130	143	203	47
Alabama.....	6	6	5	4	2	2	5	2	2	4	---
Arizona.....	3	2	1	1	1	---	2	---	---	1	---
Arkansas.....	---	---	---	---	---	---	---	---	---	---	---
California.....	12	12	8	7	1	5	9	5	5	8	3
Colorado.....	4	3	4	4	1	2	4	2	2	3	---
Connecticut.....	5	5	4	4	---	2	5	1	1	2	---
Delaware.....	---	---	---	---	---	---	---	---	---	---	---
District of Columbia.....	4	3	1	3	1	1	2	2	2	3	1
Florida.....	7	6	6	6	1	3	4	4	4	4	1
Georgia.....	8	7	6	7	3	1	4	3	1	2	1
Idaho.....	2	1	---	---	---	---	1	---	---	---	---
Illinois.....	23	18	14	19	4	8	16	10	11	14	4
Indiana.....	14	9	7	10	1	4	9	8	6	8	3
Iowa.....	8	8	5	7	3	3	4	3	3	2	---
Kansas.....	12	10	11	6	4	4	10	5	6	7	2
Kentucky.....	6	4	4	5	1	4	5	2	3	2	2
Louisiana.....	6	5	5	6	2	2	5	4	2	2	1
Maine.....	---	---	---	---	---	---	---	---	---	---	---
Maryland.....	2	2	---	---	---	1	2	1	---	---	---
Massachusetts.....	14	12	4	9	---	3	6	---	5	9	---
Michigan.....	10	9	8	9	2	3	8	4	4	6	3
Minnesota.....	17	14	12	11	1	8	15	9	11	13	3
Mississippi.....	2	2	1	2	---	1	2	1	---	---	---
Missouri.....	16	14	11	14	4	8	13	8	8	11	2
Montana.....	2	2	1	1	1	1	1	1	---	---	---
Nebraska.....	9	6	3	4	1	2	5	1	5	3	2
Nevada.....	1	1	1	1	1	1	1	1	---	1	1
New Hampshire.....	2	1	---	---	---	---	1	---	1	1	---
New Jersey.....	7	5	5	4	2	3	6	3	1	2	---
New Mexico.....	1	1	---	---	---	---	---	---	---	1	---
New York.....	23	20	13	19	2	8	15	5	13	6	5
North Carolina.....	4	3	3	3	2	1	4	---	1	2	1
North Dakota.....	2	---	2	2	---	---	2	---	---	---	---
Ohio.....	15	14	11	14	2	5	12	6	6	10	3
Oklahoma.....	5	3	3	3	2	1	2	2	---	1	---
Oregon.....	2	1	1	2	---	1	1	1	1	1	1
Pennsylvania.....	30	28	17	25	6	12	23	15	14	21	4
Rhode Island.....	2	1	1	2	---	---	---	1	1	1	---
South Carolina.....	6	4	5	5	---	3	5	2	---	2	---
South Dakota.....	1	1	1	1	---	---	1	---	1	1	---
Tennessee.....	7	5	4	6	2	1	4	1	2	3	---
Texas.....	32	25	26	23	9	7	26	10	9	19	1
Utah.....	5	5	4	5	2	5	4	---	2	5	---
Vermont.....	3	3	3	3	---	1	1	---	---	2	---
Virginia.....	7	6	5	4	1	3	6	2	2	6	3
Washington.....	7	4	4	6	2	1	3	1	1	3	---
West Virginia.....	3	1	1	---	---	---	1	1	---	1	---
Wisconsin.....	13	11	8	7	1	2	7	2	6	9	---
Wyoming.....	2	2	---	---	---	1	2	1	---	1	---

<sup>1</sup> Individual data will not add to the "All hospitals" totals since hospitals offer more than one type of therapy.

of treatment are usually referred to other hospitals after diagnosis. The remaining 67.8 percent of the hospitals indicate that treatment as well as diagnostic services are offered. Again this does not imply that every patient admitted would be offered treatment, but treatment would be available if it were deemed advisable. A total of 445 hospitals, or 81.5 percent of all hospitals accepting mental patients, accept psychotic patients as well as other types. Of those, 69.5 percent offer treatment and the remaining 30.6 percent offer diagnosis only. The remaining 101 hospitals do not accept psychotic patients but will accept other types; 62.4 percent of these hospitals offer treatment, and 37.6 percent do not.

However, hospitals offer varied treatment programs. Of the nine major therapy groups on which data were collected, very few hospitals offered all types. Even if all types were available, the use of these therapies would be selective and would vary depending upon the patient and the alternative therapies available.

Psychotherapy is the most widely used type of therapy (table 3); 305 or 82.0 percent of the 372 hospitals reporting treatment facilities offered psychotherapy, individual or group (57 hospitals offered group psychotherapy but 301 hospitals offered individual psychotherapy).

The next two highest groups are electrotherapy and drug therapy with 73.7 and 71.0 percent of all hospitals offering these therapies among others. The remaining therapies in decreasing order of availability percentage-wise were as follows: insulin 63.7; physiotherapy 54.6; occupational therapy 38.4; fever therapy 34.9; psychosurgery 33.3; metrazol and other shock therapy 18.3; all other therapies 12.6.

### Summary

A survey was made of the 4,716 general hospitals known to be in operation in the United States during the period of 1952-1953. More

than 99 percent of the hospitals queried replied. Forty percent of these hospitals had average daily resident patient populations of 50 or more. A significantly greater proportion of hospitals with average daily resident patient populations of 50 or more accept mental patients than those with populations under 50.

Of the 4,702 hospitals, 546, or 11.6 percent, accept patients with a suspected or actual primary diagnosis of mental illness. Of these hospitals, 67.8 percent offer treatment as well as diagnosis; the remaining 32.2 percent offer diagnosis only.

Psychotherapy is reported the most widely used therapy, with electrotherapy and drug therapy following closely.

### DOCUMENTATION NOTE

Additional tabulations of data from this survey have been deposited as document No. 4960, American Documentation Institute, Auxiliary Publications Project, Photoduplication Service, Library of Congress, Washington 25, D. C. A photoprint copy may be obtained by remitting \$2.50; a 35 mm. microfilm copy, by remitting \$1.75. Advance payment is required. Write checks or money orders payable to Chief, Photoduplication Service, Library of Congress.

The tabulations cover the following subjects:

1. Distribution of hospitals reporting acceptance of mentally ill patients by average daily number of all patients resident in hospital during year and average daily number of mental patients in residence during the year: United States, 1952.

2. General hospitals accepting mental patients and offering diagnostic workup only by type of service and average daily resident patient population of hospital: United States and each State, 1952.

3. General hospitals accepting mental patients and offering treatment by type of service and average daily resident patient population of hospital: United States, 1952.

4. Number of hospitals offering treatment for certain detailed therapies: United States and each State, 1952.

5. Percent of hospitals offering a given therapy of all hospitals offering treatment: United States and each State, 1952.

*Addressed originally to the County, City, and District Health Officers Association of New York State, this speech on performance budgeting in experimental installations merits the attention of all health administrators.*

# Performance Budgeting for the Health Department

By DANIEL KLEPAK, M.P.A.

**T**HE DISTINCTION between program budgeting and performance budgeting to me is more than a question of semantics. In my opinion, program budgeting connotes the gathering of costs by program, that is, so much to inoculate children with poliomyelitis vaccine, so much for clinics, so much for nursing services. If you can separate your costs into clearly discernible programs, then you have program budgeting. Performance budgeting, however, goes further than that. Performance budgeting is the relating of program costs to workload information. If you know the total cost for inoculating children with the vaccine, you have program budgeting. If you know how much it costs to inoculate each child, then you have performance budgeting.

Performance budgeting, as a concept, is not new. For many years various governmental jurisdictions—and most large business corporations—have financed their activities in relation

to services rendered rather than according to things to be purchased. One of the earliest installations—and still highly successful—is the system used by the Tennessee Valley Authority.

Performance budgeting received the greatest impetus in government when the Hoover Commission recommended its use throughout the Federal Government. Herbert Hoover is personally credited with devising the name of a budgeting system which concentrated on ends to be achieved by government rather than on means to be employed.

To make the concept of performance budgeting a little clearer as we go along, let's look at some of the budget tables which I worked up, strictly on an experimental basis, for the Rensselaer County (N. Y.) Department of Health.

Some of these breakdowns you might consider out of keeping with the recommended organization of public health practice, but, if you have good organization in your health department, your performance budget will mirror it.

## The Line-Item Budget

A budget for Rensselaer County Health Department as it might look spread out in pro-

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*Mr. Klepak, associate budget examiner, New York State Division of the Budget, was formerly hospital consultant, New York State Commission on Fiscal Affairs of State Government, and chief of local assistance, New York State Department of Health.*

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gram style is pictured in exhibit 1. The objects of expenditure on the left and the total amount in the last column on the right follow traditional budget form. The account categories are the standard categories used by counties in New York State.

The traditional budget shows what you purchase for your money, that is, the services of so many physicians, so many typists, and so many other types of personnel; so much for pencils, so much for laboratory supplies, so much for X-ray supplies, so much for fuel, and so on. It does not tell you what you do with your money. It doesn't speak in terms of services.

When an administrator plans a program, he must think about how he's going to immunize children or how he's going to run a tuberculosis hospital, not about how many typewriters, pen-

cils, and staples he will have to buy, how much X-ray film his clinics will need, how many bandages and plasters his nurses will apply, or how much fuel, light, and electricity his department will use. Unless he thinks in terms of services, his frame of reference is completely artificial and strait-jacketing.

The traditional budget gives very little indication of what a department or bureau expects to accomplish during the year. The tyranny of the line-item type of budget causes department heads to continue to think in terms of the tools they must use rather than of the programs they must plan and manage.

### A Planning Cycle

Performance budgeting is nothing more than a good financial tool. It is not a panacea; it is

**Exhibit 1. Distribution of costs for 1955**

Objects of expenditure		Cost centers							
Code and account		Nursing	Clinics	Sanitation	Laboratory	Social service	Maintenance	Administration	Totals
100	Personal service:								
	Salaries.....	\$82,242	\$18,078	\$42,665	\$37,840	\$8,000	\$7,250	\$46,720	\$242,795
	Temporary service.....			994	200			500	1,694
	Professional fees.....		2,295						2,295
	Board of health.....							1,800	1,800
290-628	Retirement contributions.....	8,635	1,689	4,027	3,537	750	670	4,380	23,688
290-630	Workmen's compensation.....	2,105	402	949	765	178	161	1,039	5,599
200	Equipment:								
	Automobiles.....	5,485	290	2,336				870	8,981
	Office equipment.....							1,922	1,922
	Technical equipment.....		283	75	1,000				1,358
300	Supplies and materials:								
	Laboratory supplies.....				3,600				3,600
	Office supplies.....							1,500	1,500
	Clinic supplies.....		1,256						1,256
	X-ray supplies.....		1,703						1,703
	Maintenance supplies.....						1,500		1,500
	Books and periodicals.....							400	400
	Fuel oil.....						1,500		1,500
	Printing.....				800			500	1,300
400	Other expenses:								
	Light.....						850		850
	Rent.....						2,250		2,250
	Travel (excluding auto expense).....							2,355	2,355
	Auto expense.....	8,420	447	3,543				1,335	13,745
	Telephone.....							2,750	2,750
	Inservice training.....							1,984	1,984
	Laundry.....				100				100
	Miscellaneous and postage.....							2,899	2,899
	Totals.....	\$106,887	\$26,443	\$54,589	\$47,842	\$8,928	\$14,181	\$70,954	\$329,824

<sup>1</sup> Before distribution of laboratory costs.

not a pushbutton system. With performance budgeting, you will still need professional opinion and administrative judgment to run the department, but this approach to budgeting and to planning will help you see where to direct your energies.

In exhibit 2 we see the various cost centers, or activities or programs, of the Rensselaer County Department of Health and the work units that might be used to measure them quantitatively. In performance budgeting, we try to determine measures for what is being done in any of the health department's programs. Here we are talking about measuring services quantitatively and evaluating them quantitatively, not qualitatively.

We don't try to measure every type of work. For example, the multifarious activities of an administrator of a county health department are, in my opinion, either unmeasurable, or they would take so much effort to measure that you would get little return for your effort.

Nor do we measure social service in a county health department where it may be a very small operation. However, in a large mental hospital such as the Hudson River State Hospital at

Poughkeepsie, N. Y., where the State has been installing a performance budget system, social service is a large activity, costing approximately \$100,000. There we measure social service by a yardstick or work unit called a contact, either with a patient or his relatives or his prospective employers.

With exhibit 3 we introduce a new concept to budgeting. Here we have analyzed fixed and variable costs for the county's nursing program. If we had taken 1,000 nursing visits, let's say, and divided them into the total cost of a \$5,000 nursing program, we would have obtained a unit cost of \$5.00 for each visit. But that, we feel, is an erroneous way of thinking. Costs have different properties. Some costs are fixed. Others are variable.

In a tuberculosis hospital, for example, the cost of food increases with every additional patient fed. Food is clearly a variable cost. It increases and decreases with the number of hospital patients. But the salary of a dietitian and the salary of the head of the hospital are truly fixed or overhead costs. Since those costs remain constant regardless of the number of people cared for in a hospital, or the number of people visited in a nursing program, we discriminate, in our budgeting system, between variable and fixed costs.

If your nurses were making 10,000 visits a year, and you were to decrease the number of visits by one-half, to 5,000, you could not get along on half your prior appropriation. Only those costs which vary with workload could be decreased. Similarly, if you enlarged the scope

Exhibit 2. Cost centers and units of measurable work

Code and cost center	Work unit
01 Nursing-----	Visit.
02 Clinics-----	Clinic session.
03 Sanitation-----	{Inspection. {Weighted inspection. <sup>1</sup> {Test.
04 Laboratory-----	{Weighted specimen point. <sup>2</sup>
05 Social service-----	None. <sup>3</sup>
06 Maintenance-----	None. <sup>3</sup>
07 Administration-----	None. <sup>3</sup>

<sup>1</sup> All inspections classified and weighted according to personnel time spent on each type of inspection.

<sup>2</sup> New York State Association of Public Health Laboratories has recommended adoption of a uniform weighting system for all public health laboratory procedures. Because all local laboratories will probably adopt it for reporting purposes and the recommended standards are reasonably related to activities at Rensselaer County Laboratory, the system has been adopted.

<sup>3</sup> None does not mean that no measurable units exist but rather that incurred costs are so relatively fixed that no useful planning or control purpose would be served by comparing costs with units of work done or that the identification and reording of measurable units of work would be uneconomical compared with possible benefits to be gained.

Exhibit 3. Breakdown of fixed and variable costs: nursing costs

Code and item	Variable	Fixed
100 Personal service:		
Director of nursing-----		x
Supervising nurses (2)-----	x	
Public health nurses (17)-----	x	
Physiotherapist-----	x	
Stenographers (3)-----	x(2)	x(1)
Clerk-----	x	
200 Equipment:		
Automobiles-----	x	x
300 Supplies and materials-----		
400 Other expense:		
Automobile expense-----	x	x



of your program, you would not need an increase in funds in proportion to the size of the increased workload. Your fixed costs would remain relatively constant.

Exhibits 4 and 5 show the 1955 workloads for Rensselaer County's nursing program and the clinic program as they looked in December 1954.

**Exhibit 4. Nursing visits forecast for 1955**

Type of visit	Number of visits in—			Forecast for 1955	
	1952	1953	1954 <sup>1</sup>	18 PHN's <sup>2</sup>	24 PHN's
Maternity.....	2,556	1,683	1,865	2,750	6,000
Health guidance.....	8,581	5,095	5,424	6,550	12,000
Communicable disease <sup>3</sup> .....	6,781	3,696	2,919	4,400	4,400
Chronic disease.....	2,692	3,191	3,341	1,000	1,000
Other noncommunicable disease.....	4,909	3,632	2,046	1,200	1,200
Other neuromuscular skeletal disorders.....	1,968	1,209	1,275	1,200	1,750
School nursing.....	276	355	197	215	215
Totals.....	27,763	18,861	17,077	17,315	26,565

<sup>1</sup> Fourth quarter of 1954 is estimated.

<sup>2</sup> Staff of 18 public health nurses is basis for forecast; next column shows visits expected with increase in staff.

<sup>3</sup> Includes tuberculosis.

**Exhibit 5. Clinic workload forecast for 1955**

Type of clinic	Total for 1955	Number of clinics per quarter			
		1st	2d	3d	4th
Child health.....	138	30	36	36	36
Tuberculosis screening.....	16	4	4	4	4
Tuberculosis consultation.....	96	24	24	24	24
Diabetes screening.....	240	60	60	60	60
Immunization.....	58	12	22	12	12
Dental hygiene.....	660	165	165	165	165
Totals.....	1,208	295	311	301	301

**Exhibit 6. Standard cost data for nursing program, 1955**

Code and account		Variable costs		Annual fixed costs
		Work unit	Unit cost	
100	Personal service:			
	Salaries.....	Visit.....	\$4.23	\$9,000
290-628	Retirement contributions.....	Visit.....	.45	843
290-630	Workmen's compensation.....	Visit.....	.11	200
200	Equipment:			
	Automobiles.....	Visit.....	.30	290
300	Supplies and materials.....			
400	Other expenses:			
	Automobile expense.....	Visit.....	.46	455
	Variable cost per unit.....	Visit.....	\$5.55	
	Total fixed costs.....			\$10,788

**Exhibit 7. Standard cost data for clinics, 1955**

Code and account		Variable costs		Annual fixed costs
		Work unit	Unit cost	
100	Personal service:			
	Salaries.....	Clinic.....	\$11. 24	\$4, 500
	Professional fees.....	Clinic.....	1. 90	
290-628	Retirement contributions.....	Clinic.....	1. 05	421
290-630	Workmen's compensation.....	Clinic.....	. 25	100
200	Equipment:			
	Automobiles.....	Clinic.....	. 24	
	Technical equipment.....	Clinic.....		283
300	Supplies and materials:			
	Clinic supplies.....	Clinic.....	1. 04	
	X-ray supplies.....	Clinic.....	1. 41	
400	Other expenses:			
	Automobile expenses.....	Clinic.....	. 37	
	Variable cost per unit.....	Clinic.....	\$17. 50	
	Total fixed costs.....			\$5, 304

Performance budgeting almost forces the program supervisor to go through a complete planning cycle. He must judge how much work he expects his program will accomplish, what kind of work it will be, and how it will be done. Without such planning, there is little basis for forecasting costs or later for comparing planned operations with actual operations.

Three exhibits—6, 7, and 8—demonstrate the standard costs of a nursing visit, clinic session, and sanitary inspection.

In exhibit 6 we have taken all the costs that

were generated by the nursing program, obtained unit costs on a visit basis for those variable costs described previously, and found that a nursing visit costs \$5.55 in Rensselaer County. In addition, there are fixed costs of \$10,788 for the year 1955.

A standard cost does not reflect what ideally a nursing visit or sanitary inspection should be in Rensselaer County. It simply reflects what is true at that time. In late 1954 it cost the county \$8.65 to make a sanitary inspection.

The fact that unit costs differ is simply an

**Exhibit 8. Standard cost data for sanitation activities, 1955**

Code and account		Variable costs		Annual fixed costs
		Work unit	Unit cost	
100	Personal service:			
	Salaries.....	Inspection.....	\$5. 39	\$11, 160
	Temporary services.....	Inspection.....	. 17	
290-628	Retirement contributions.....	Inspection.....	. 51	1, 016
290-630	Workmen's compensation.....	Inspection.....	. 12	248
200	Equipment:			
	Automobiles.....	Inspection.....	. 35	290
	Technical equipment.....			75
300	Supplies and materials.....			
400	Other expenses:			
	Automobile expense.....	Inspection.....	. 53	445
	Distribution:			
	Laboratory service.....	Inspection.....	1. 58	
	Variable cost per unit.....	Inspection.....	\$8. 65	
	Total fixed costs.....			\$13, 264

### Exhibit 9. Operating budget for calendar year 1955

Cost center	Variable costs			Fixed costs	Total costs
	Forecast work units	Allowance per unit	Total		
Nursing.....	17,315 visits.....	\$5. 55	\$96, 099	\$10, 788	\$106, 887
Clinics.....	1,208 clinics.....	17. 50	21, 139	5, 304	26, 443
Sanitation.....	5,845 inspections.....	8. 65	50, 568	13, 264	68, 832
Laboratory:					
Gross budget.....	40,000 tests.....	. 711	28, 440	19, 402	47, 842
Distribution to sanitation.....	—13,000 tests.....	(. 711)	—9, 243	-----	—9, 243
Net budget.....	27,000 tests.....	. 711	19, 197	19, 402	38, 599
Social service.....				8, 928	8, 928
Maintenance.....				14, 181	14, 181
Administration.....				70, 954	70, 954
Totals.....			\$187, 003	\$142, 821	\$329, 824

index of a different type of operation or a more efficient operation. You cannot say that because one standard cost is less than another it is therefore better. Costs simply reflect the fact that one service is different from another. If the services are supposed to be substantially the same, then there should be administrative and professional scrutiny to determine what the difference means. It might mean better service, or it might mean inefficiency, but its meaning, whatever it is, cannot be determined from the budget. Performance budgeting

spotlights the problem. For its solution, you still need trained professional and technical personnel.

Under performance budgeting, the operating budget for a calendar year might appear as tabulated in exhibit 9. Here, instead of listing needs for fuel, pencils, and salaries, you budget as you normally plan your program. The table illustrates a budget for various programs: how much work the Rensselaer County Health Department expected to do in 1955, how much each work unit would cost, the total variable cost,

### Selected References

Readers wishing further enlightenment on the application of performance budgeting to health department accounting systems are referred to the following articles which Mr. Klepok has written:

- Performance Budgeting for Hospitals and Health Departments (published by Municipal Finance Officers Association of the United States and Canada, Accounting Publication Series No. 11-6, Chicago, June 1956).

- Financial Tools for Effective Hospital Administration (Hilleboe and James, co-authors; published in Hospitals, Journal of the American Hospital Association; part 1 in April 16, 1956, issue, pp. 50-51, 55, and part 2 in May 1, 1956, issue, pp. 36-40).

- Fiscal Research in Public Health (Hilleboe and James, co-authors; published in Journal of the

American Public Health Association, July 1955, pp. 906-914).

- Program Accounting Test of the Rensselaer County (N. Y.) Department of Health (published by the Temporary New York State Commission on the Fiscal Affairs of State Government, Albany, N. Y., 1955).

Other useful information on performance budgets may be found in "Performance Budgeting and Unit Cost Accounting for Governmental Units," another publication of the Municipal Finance Officers Association (Accounting Publication Series No. 11-2, Chicago, 1954) and in "Performance Budgeting: Selected References," a bibliography prepared by the United States Bureau of the Budget Library and issued in 1951.

Exhibit 10. Tuberculosis hospital summary performance

Cost center or department of the hospital	Budget estimate	Actual cash expenditures	Difference between amounts budgeted and spent (col. 1—col. 2)	Workload	
				Planned	Actual
	(1)	(2)	(3)	(4)	(5)
Outpatient department.....	\$63, 431	\$64, 174	—\$743	7,500 exams.....	8,492 exams.....
Inpatient care:					
Ward service.....	310, 326	283, 793	26, 533	91,250 patient-days..	88,782 patient-days..
Ancillary professional service.....	40, 335	45, 392	—5, 057		
Surgery.....	103, 819	96, 723	7, 096	225 major operations..	197 major operations..
Laboratory.....	37, 797	37, 786	11	35,000 tests.....	37,152 tests.....
X-ray.....	22, 963	25, 781	—2, 818	3,350 X-ray exams....	3,439 X-ray exams....
Food service.....	212, 820	205, 054	7, 766	282,052 meals.....	267,774 meals.....
Laundry.....	40, 123	40, 112	11	418,600 pounds.....	407,280 pounds.....
Housekeeping.....	112, 925	105, 666	7, 259		
Maintenance.....	107, 216	105, 757	1, 459		
Power plant.....	76, 678	74, 917	1, 761		
Administration.....	125, 357	121, 359	3, 998		
Totals.....	\$1, 253, 790	\$1, 206, 514	\$47, 276		

the fixed or overhead cost, and the total amount to be requested.

A performance budgeting system is coupled with a statistical and financial reporting system. No accounting or budgetary system is worth anything unless it provides useful information to management.

#### Values for Administration

An attempt to show the complete operations of a hospital over a year may be seen in exhibit 10. The hospital is Home Folks Tuberculosis Hospital, Oneonta, N. Y., where our division has also set up an experimental performance budget.

Actually, you can't show in one summary table, or on one piece of paper, the complete operations of a large organization and make them definitive and of great value. You would require more than that for an actual reporting system. The sample table is simply intended to illustrate the type of information you can get from performance budgeting. It will show the areas needing further scrutiny.

On the left, in column 1, we note that the outpatient department is authorized to spend \$63,431. It actually spent \$64,174. By subtracting column 2 from column 1 we see that the difference is \$743. That's as far as we go in traditional budgeting systems. But this type of summary report goes further. It shows how much work you said you were going to do.

The hospital planned 7,500 outpatient examinations, but the actual workload was almost 1,000 more. Therefore, by projecting the amount of work planned and the amount of work actually done in terms of the unit cost for a single outpatient examination, we show the planned cost in column 8 and the actual cost in column 9. Column 10 indicates that the hospital should have been able to spend \$6,211 more than budgeted for outpatient work because it performed approximately 1,000 more examinations than forecast. Therefore, column 11 shows the net result is not failure to live within the budget by \$743 but actually a net savings of \$5,468 because in fact the outpatient department did \$6,211 worth of additional work for only \$743.

Standard unit cost (variable)		Workload expressed in terms of cost (workload $\times$ unit cost)		Savings or overspending caused by changes in workload (col. 9 - col. 8)	Savings or overspending beyond workload requirements (col. 3 + col. 10)	Cost center or department of the hospital
Original work units	Expressed in patient-days	Planned (col. 1 $\times$ col. 6)	Actual (col. 5 $\times$ col. 6)			
(6)	(7)	(8)	(9)	(10)	(11)	
\$6.26	-----	\$46,951	\$53,162	\$6,211	\$5,468	Outpatient department.
2.69	\$2.69	245,652	239,010	-6,642	19,891	Inpatient care:
					-5,057	Ward service.
						Ancillary professional service.
206.05	.51	46,362	40,592	-5,770	1,326	Surgery.
.40	.16	14,173	15,044	871	882	Laboratory.
1.11	.04	3,714	3,812	98	-2,720	X-ray.
.54	1.84	168,010	145,348	-22,662	-14,896	Food service.
.07	.31	31,048	30,208	-840	-829	Laundry.
					7,259	Housekeeping.
					1,459	Maintenance.
					1,761	Power plant.
					3,998	Administration.
						Totals.
	\$5.58	\$555,910	\$527,176	-\$28,734	\$18,542	

Administrators of health programs undoubtedly are interested in the direct uses of the performance budget. Here, we simply itemize some of them.

### *For Expenditure Control*

Continuous cost consciousness is developed at all levels. Variances from budget show up currently.

"Responsibility accounting" concept places responsibility for cost as well as program control on operating supervisors.

Fixed-variable concept points up how costs should relate to workload.

Use of standard costs encourages the setting of staff performance standards.

Planned and actual workload and costs are compared and analyzed currently.

High-cost operations are spotlighted for study on an administrative management basis.

### *For Budgeting*

Data are available for policy decisions; for example, evaluation of boarding care as compared with institutional care.

Costs may be compared among units or institutions and private agencies, for example, private laundry service as compared with institution laundry service, or production of vaccines in commercial laboratory as compared with public laboratory.

Costs are related to accomplishments and objectives so that evaluation of use of funds is facilitated.

Standards, once they are developed, can be examined throughout the year. Once accepted, the budget process becomes one of making decisions as to extent of the program, for example, the number of patients to be hospitalized or the miles of road to be constructed. In this way, it is possible to even the budget examination process so as to reduce or eliminate the peak rush of budget making.

### *For Presentation*

You can tell at a glance the cost of a program or activity and, in many cases, the cost of each unit.

The budget becomes more informative and understandable.

# Insecticide Resistance Of *A. quadrimaculatus* In Bolivar County, Miss.

By WILLIS MATHIS, B.S., H. F. SCHOOF, Ph.D.,  
KENNETH D. QUARTERMAN, B.S., M.P.H., and  
RICHARD W. FAY, Ph.D

*The data represent the first detection of resistance in Anopheles quadrimaculatus to chlorinated hydrocarbon insecticides and initial establishment of anopheline resistance to dieldrin.*

• • •

DESPITE the widespread use of DDT residual applications for the eradication of malaria in the southeastern United States during the period 1946 to 1950, there has been no indication that *Anopheles quadrimaculatus* (Say) has developed resistance to this compound. Kruse and associates (1) reported that *A. quadrimaculatus* became less susceptible to larvicidal treatments of DDT in the Tennessee Valley Authority malaria control program, but later studies (2) indicated that factors other than resistance were responsible for the apparent lack of effectiveness of the control operations.

However, field studies in Bolivar County, Miss., now demonstrate that, while *A. quadrimaculatus* in that area is still susceptible to DDT, it is highly resistant to dieldrin, BHC, and chlordane.

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*The authors are all with the Communicable Disease Center of the Public Health Service. They are stationed in Savannah, Ga., with the Technical Development Laboratories where Mr. Quarterman is chief. Mr. Mathis and Dr. Fay are entomologists, and Dr. Schoof is chief of the Biology Section.*

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The first indication of resistance in this species was noted in field tests, employing the method of Fay and associates (3). In these tests an average 24-hour mortality of 15 percent was obtained when 62 adult mosquitoes (3 replicate tests) were exposed to paper treated by immersion in a 0.25 percent dieldrin-xylene solution.

To substantiate this apparent loss of susceptibility to dieldrin, further tests were conducted with paper treated by immersion in 0.25 percent and in 1.0 percent dieldrin solutions. DDT-treated surfaces also were assayed. The female mosquitoes used were collected from natural resting places at five widely separated locations in Bolivar County during June and July 1955 and held overnight with food and water before their exposure to chemical residues. The results of these tests clearly indicated that *A. quadrimaculatus* was highly resistant to dieldrin residues although quite susceptible to deposits of DDT (table 1).

Since the dosage of the toxicants per square foot was unknown in the foregoing tests, additional tests were run using the technique of Fay and associates (4) in which plywood panels were treated with known dosages of the toxicant. Four chemicals were evaluated: DDT at 200 mg./sq. ft., dieldrin at 25, 50, 100, and 200 mg./sq. ft., BHC at 50 mg./sq. ft., and chlordane at 100 mg./sq. ft. The exposure period was 30 minutes, except for the DDT tests in which 30-, 60-, and 120-minute periods were employed.

To compare the susceptibility of the Bolivar County *A. quadrimaculatus* with that of non-resistant *A. quadrimaculatus*, parallel tests were conducted at the Public Health Service Technical Development Laboratories, Savannah, Ga., with a laboratory-reared strain (TDL). The adult mosquitoes of the TDL strain were processed in the same manner as the Bolivar County adults. The plywood panels used in the tests were sprayed in quadruplicate sets at Savannah. After the treatment, two sets of panels of each dosage were tested at Savannah against the laboratory strain. Two sets of panels (one

**Table 1. Percentage mortality in 24 hours of female *Anopheles quadrimaculatus* exposed for 45 minutes to dieldrin and DDT residues**

Treatment	Number of replicates	Total females	Adjusted 24-hour mortality <sup>1</sup> (percent)
Dieldrin, 0.25 percent.....	38	787	18
Dieldrin, 1 percent.....	4	79	6
DDT, 1 percent.....	38	821	96
Check.....	15	341	3

<sup>1</sup> Based on Abbotts formula.

tested, one untested) were then forwarded to Mississippi. A similar pair of panels was retained at Savannah.

From the results of the panel tests with residues aged 1 to 13 days, it is readily apparent that the Bolivar County strain is highly resistant to dieldrin (table 2). Deposits of 100 and 200 milligrams per square foot produced average mortalities of 5 percent or less for this strain, compared with the 98 percent mortality achieved for the TDL strain with 25 milligrams of dieldrin per square foot. The data likewise show that the Bolivar County strain has little susceptibility to BHC and chlordane at the dosages normally used for residual applications.

Although the 30-minute exposure to DDT resulted in low mortalities for both strains, these low rates are considered to reflect the length of the exposure period rather than resistance to the pesticide. In 1948, tests with the TDL strain at 30-minute exposures to 200 milligrams of DDT per square foot produced average mortalities of 44 percent (4). In the present tests with the Bolivar County strain, the mortality rates were 51 and 85 percent, respectively, following 60-minute and 120-minute exposures to replicate panels, each sprayed with 200 milligrams of DDT per square foot. Moreover, exposure to paper treated with 1-percent DDT produced an average mortality of 96 percent for the Bolivar County strain (table 1).

The development of resistance in this species to dieldrin, chlordane, and BHC apparently is due to the extensive use of these pesticides in agriculture and for the control of malaria mosquitoes. Bolivar County is largely agricultural with cotton the chief crop. Insect control on cotton requires repeated insecticidal applications, many of which are made by airplane dusting. According to the Bolivar County agricultural agent and the local pesticide companies, the insecticides used in 1955 in the order of the quantities dispersed were dieldrin, toxaphene,

**Table 2. Percentage mortality in 24 hours of adult *Anopheles quadrimaculatus* from Bolivar County, Miss., and those of a laboratory strain exposed for 30 minutes to insecticidal deposits on plywood panels**

Pesticide	Mg./sq. ft.	Strain	Replicates	Total females	Mortality (percent)
Dieldrin.....	25.....	{Bolivar County.....	1	25	8
		{TDL.....	4	258	98
	100.....	{Bolivar County.....	1	23	5
		{TDL.....	4	229	100
	200.....	{Bolivar County.....	20	496	0
		{TDL.....	4	233	100
BHC (36 percent gamma isomer).....	50.....	{Bolivar County.....	10	244	3
		{TDL.....	4	213	67
Chlordane.....	100.....	{Bolivar County.....	10	248	5
		{TDL.....	4	205	44
DDT.....	200.....	{Bolivar County.....	20	485	53
		{TDL.....	4	223	50

<sup>1</sup> In one test the mortality was only 13 percent; in the remaining three it was 94, 100, 100.

<sup>2</sup> 1-day-old residues (2 replicates) gave 87 percent mortality.

<sup>3</sup> Mortality for individual tests ranged from 13 to 95 percent.

<sup>4</sup> 1-day-old residues gave a mortality of 25 percent; 13-day-old residues, a mortality of 83 percent.

endrin, DDT plus BHC, DDT, and aldrin. DDT generally is not used until August, whereas the other pesticides are employed as early as June. Presumably, the airplane and ground dusting techniques employed provide ample opportunity for treating both the larval and adult stages of the mosquito. In addition, Bolivar County has conducted a residual spray program for malaria control in rural areas since 1944. DDT and DDT-chlordane formulations have been used in this program, the latter since 1950.

The level of susceptibility to dieldrin was suggested in 1953, in Mississippi, when heavy dosage of this chemical (0.5 to 1 lb./acre) failed to provide control of anopheline larvae in rice fields (5) even though similar applications in landlocked ponds near Savannah, Ga., had been satisfactory (6). In the Savannah tests, however, the general mosquito population was only slightly affected by the test applications, whereas in Mississippi the dust treatment of cotton exposed both the adult and larval stages of the mosquitoes to the insecticides over considerable areas.

An attempt is now in progress to colonize the

Bolivar County strain so that it will be available for bioassay purposes.

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## Army Posts Fluoridate Water Supplies

There are 21 Army posts in the United States, Alaska, Hawaii, and Puerto Rico which now fluoridate their water supplies, according to recent information made available by the Army Surgeon General.

Requests for fluoridation are submitted to the Surgeon General and are accompanied by a report on the natural fluoride content of the water on the post and a statement of the number of persons to benefit from the procedure.

The age of the population at an installation is one of the criteria for determining the priority for setting up the fluoridation process. A census must be taken of the number of persons under 12 years of age, the number between 12 and 16, and those between 16 and 20 years living on the installation and reported with the application for fluoridation.

The Committee on Dentistry of the National Research Council has supported fluoridation of water supply for use on military posts whenever feasible and especially where there is a child population in residence. The Army Medical Service approved the fluoridation of drinking water at Army installations in July 1954.



*The Queens Rehabilitation Program is designed to provide total rehabilitation for children handicapped with orthopedic, neuromuscular, or cardiac disabilities through enlisting the cooperation, and coordinating the activities, of professional groups, interested agencies, organizations, and individuals in the community.*

## Queens Rehabilitation Program for Handicapped Children

By LEONARD W. MAYO, S.Sc.D., and ROBERT M. WEBB, M.S.

**N**O MATTER what the size of a community, its future rests on the well-being of each of its members. Among the members of every community are those who are economically deprived, emotionally or mentally ill, or physically handicapped. These impairments are often such that they interfere, to a greater or lesser degree, with adequate functioning on the part of the individual in the community's

enterprises, whether these enterprises are learning, making profitable use of leisure time, or earning a living.

In order to sharpen the focus from a broad and hazy look at the variety of differences in communities and in individuals, let us adjust our lens to pick out one physically handicapped child in a large metropolitan area and try to discover what may be done to help him through a more effective organization of the community.

Seen by a casual observer, Harry appears to be a pretty normal boy. His eyes are alert and clear, and he looks intelligent; his shoulders are broad and sturdy; and his appearance is neat, at least not any dirtier than the usual accumulation which 12-year-olds can assemble without obvious effort. But if you watched him walk, you would not notice the upper portion of his body because his right leg has been amputated at the knee, and he uses crutches.

### Understanding for Harry

People who see Harry on the street for the first time usually react with pity. Sometimes they offer to help him across the street or give him a seat on a crowded bus. Some turn their eyes away so as not to embarrass him. Sometimes his contemporaries show a different reac-

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*Mr. Webb has been director of the Queens Rehabilitation Program, Jamaica, N. Y., since its inception in 1954. His earlier career included posts with the Department of Welfare and the Domestic Relations Court, New York City, the Queensboro Council for Social Welfare, Jamaica, and the Stamford (Conn.) Community Council.*

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tion: "Hello, Crip. Bet you can't do this." Whatever their reaction, it is frequently not one of acceptance, understanding, or a desire to help. As a matter of fact, most people, adults as well as children, do not know how to help. They may remember Harry when they are asked for money for Easter Seals or the March of Dimes as a kind of payment to the gods for their own healthy bodies, but they are not very likely to get Harry into their clubs at church, their activities at school, or their outings at the beach unless they do so in a way that makes him feel "special" and "different."

What is Harry really like? How does his family feel about him? How does he feel about himself? What does he need to help make him whole? Can he find this help in his community? Taking everything into account, what can his neighbors and the community do in a practical and constructive way to help him make the grade and, at the same time, add to his own self-respect?

In Harry's community, the Borough of Queens in New York City, there is a demonstration program set up to help answer these questions. Sponsored and financed initially by the Association for the Aid of Crippled Children, it is called the Queens Rehabilitation Program. Part of the program is a diagnostic and evaluation center, called a division, in one of the public hospitals in the borough. Harry's physician learned of this, and sent him there to be thoroughly studied so that recommendations could be made for his rehabilitation—emotional, mental, and spiritual, as well as physical.

Harry and his mother came to the diagnostic and evaluation division of the Queens Rehabilitation Program where an appointment had been made. Harry did not have to wait in a cheerless room for a long time. He waited a while because it is a busy place, but the room is attractive, and there are magazines and books to look at. The physician saw Harry and his mother in a private examination room. When Harry had been given a thorough medical examination, a social worker talked to the mother and learned about the home, the other children in the family, and their relations with each other, the father and his job and earning capacity; the mother's feeling about Harry ("Harry's

a good boy, but he broods an awful lot") and her attitude toward his disability ("Of course, I love him, but, well, it's hard to know how to treat him like the others. His crutches and all make him different").

That same day, if there was time and Harry was not too tired, or maybe another day by appointment, Harry saw a physical therapist who made an evaluation of his muscular development, his ability to walk, to climb stairs, to handle his crutches, and the strengths and weaknesses of his limbs. An occupational therapist saw him, too, and tested his coordination, his ability to dress and undress, and his capacity for the many activities of daily living. A speech therapist tested his facility with words, and a psychologist gave Harry a battery of tests which showed his intellectual capacity, his learning ability, and his deeper attitudes and feelings about himself and his relation to other people. A medical specialist in orthopedics took a careful look at his leg to determine whether it was possible or advisable to use some appliance other than crutches to help him walk.

Finally, after all these specialists had an opportunity to become acquainted with Harry and his family, and after they had made a thorough evaluation of him and his needs from their own points of view and consulted with each other to check their findings; after all available information from his school, his church, his family, and other agencies which have had to do with him in the past was correlated—the team got together and put all the pieces into one comprehensive and total evaluation of Harry as a whole person. What did they find?

Harry's is a relatively simple story. He set off one Sunday, ostensibly for church, with some change in his pocket for the collection but landed instead in a movie theater. Timing himself so that he would get home when he was expected, he left the theater to cross the street to a bus stop. As he ran from behind a parked car, he stepped into the path of an automobile, leaving no time for the driver to stop. Amputation saved Harry's life but cost him his leg.

Before the accident Harry had not been happy at school. He attended sporadically, using any available excuse to stay away, truanting with increasing frequency despite punish-

ment. Examinations showed that his hearing was defective, but this was not known until after the accident. His brothers and sisters, although not as well endowed intellectually, did better at school and were favored by their parents for this reason. Harry's father resorted to severe physical punishment to deal with him, and this, combined with the obvious preference shown by his mother for the other children, made the boy feel rejected and bitter. He was ready to use his disability as a means of getting even with his parents and as a means of avoiding school legitimately. Yet, at the same time he thought of his amputation as a punishment for his truancy and particularly for his deceit in not going to church the day he was injured.

### The Rehabilitation Program

What to do for Harry? A useful and simple solution would be to fit him with a prosthetic appliance so that he could walk without crutches and look very much like other boys.

Simple? Yes, except for the painstaking patience Harry would need to learn to walk again, to go through with the fittings and adjustments, and to get accustomed to the artificial leg. Above all, Harry had to want to walk and be willing to give up the newly found means of getting attention and favored treatment his crutches had given him.

Another easy matter would be to supply him with a hearing aid so that he could follow the teacher's instructions and understand the work in class and thus be able to put his intelligence to use. Easy? Yes, except for the adjustment to the hearing device and the reshaping of a boy's whole lifetime of feelings about school and other people.

And what about Harry—not merely his physical problems, as important as they were—but Harry as a person? A pattern of truancy is not easy to change. A fear of physical punishment for any infraction of rules is not readily overcome. The deep guilt which Harry felt because "God punished him" by destroying his



leg is difficult to clear up. If it takes time to learn to use an artificial leg and a hearing aid, how much more time and skill are needed to set straight the deep emotional disabilities that had ridden him even longer, and that his poor hearing and his traumatic experience served to aggravate?

The diagnostic and evaluation division of the Queens Rehabilitation Program sent its recommendations to Harry's physician, who arranged to get the prosthetic appliance and the hearing aid. At the physician's request, the physical therapist at the division helped to train Harry in the use of his new leg, and the speech therapist taught him to use his new "ears." Their work was carefully checked as they went along by competent medical men—Harry's own physician and specialists. But Harry's physician was at a loss to know where to get the help that the recommendations made it obvious Harry needed. He fully accepted the recommendation for guidance for Harry and his parents, but where could he turn to get the expert advice?

The physician understood that the Queens Rehabilitation Program included services other than those of the diagnostic and evaluation division, for a friend of his was serving on a committee of the program which concerned itself with the development of such services as Harry and many other handicapped children need.

It is the aim of the program to locate the children who need service, to acquaint the agencies, hospitals, and other facilities with their needs, and to stimulate such organizations to provide the care which the children require. Harry's physician is one of hundreds of Queens citizens who take an active part in this endeavor, and he knows that Harry's case is not unique. Although it was an accident that caused the boy to lose his leg, there are children suffering from poliomyelitis, cerebral palsy, muscular dystrophy, and cardiac conditions, and children who are congenitally malformed or who have suffered a birth injury. Many need help, and it is for all, rather than for any one group exclusively, that the Queens Rehabilitation Program exists. The program is planned to demonstrate that, through community organization methods, it is possible to help the handicapped children of a community with the services that exist or can be developed, and

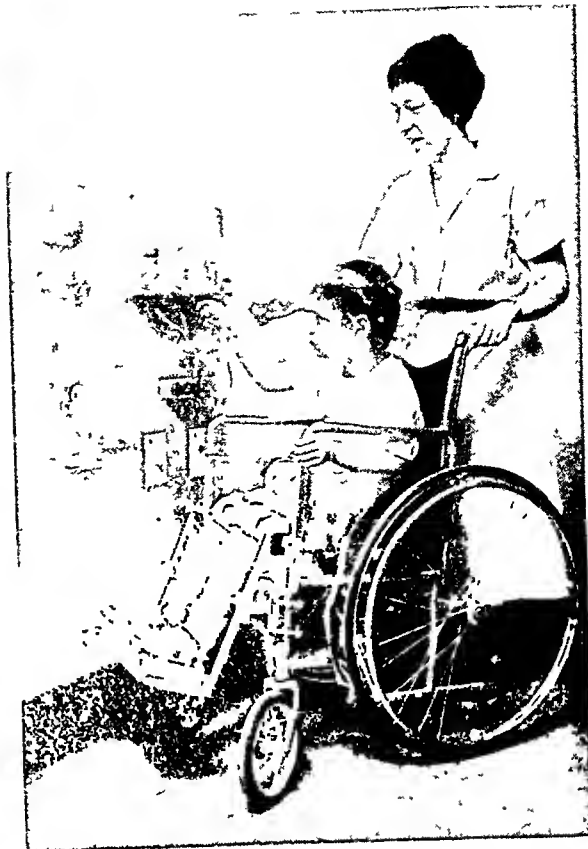
that it is not always necessary or desirable to construct a building in which to house a rehabilitation center.

How is this being accomplished? What are the methods and tools of community organization, and how can Harry and others be better served because of them? As those experienced in the process will know, community organization is neither coercion nor manipulation, nor does it consist of imposing a pattern upon a community according to a preconceived plan, whether or not the community wants it. Community organization provides for bringing the principal elements of a community together under skillful leadership to face the most important things that need to be done in any field, deciding how they can be accomplished, and then carrying out a plan of action. In the Queens Rehabilitation Program, these things were done in the following way.

#### Basics of Community Organization

First there was an idea. In this instance, the idea was that a better job could be done in finding and treating the handicapped children and youth of the Borough of Queens. The idea had to be tested against the experience of responsible persons. It was discussed with public officials, department heads, hospital administrators, and experts in rehabilitation. When it seemed to be correct, according to the advice received from these persons, the next step was to get together a representative group of Queens residents and lay the idea before them for their reactions and their suggestions. They were the people who knew their community and might be expected to be able to give a correct evaluation of their community's willingness and readiness to accept a demonstration such as the one proposed, to work with it, and to cooperate in its aims.

Here was the place where a fundamental concept of community organization was used, namely, that no program may be expected to succeed unless the responsible leadership of the community is behind it. The group called together was representative in the statistical rather than the sociopolitical sense, as Alexander and McCann (1) make the distinction. That is to say, there were people from educa-



tion, government, medicine, social work, and civic and fraternal work—not elected by the organizations to which they belonged, and not officially speaking for those organizations. For example, the president of the medical society expressed the general views of organized medicine, but he was not delegated by the society for the purpose of expressing its majority opinion on a specific issue.

The group, designated later as a planning and coordinating committee, discussed the plans and proposals which had been submitted to it by the Association for the Aid of Crippled Children and suggested some amendments.

After several meetings, there was agreement that a demonstration program should be undertaken in Queens, and that it should have five main areas of concern: case finding, care and treatment, recruitment and training of professional personnel, public education, and research. In order to work out the details of methodology, separate subcommittees were set up. Again, careful selection was made to assure the participation of as representative a group of people

as possible in order to secure the advice and guidance of the people most closely concerned with the work with handicapped children and to make sure that these people took an active partnership role in the development of the program. It was considered important that its growth should be along lines which they chose as important, and that, as it progressed, it should be their program and not one imposed on them or which they were "talked into" supporting. It is a simple but important principle of community organization that sound progress is achieved only when the community itself understands, supports, and is a part of that progress. It is frequently easier and faster to raise funds for the construction of a building than to work out other and perhaps better ways of serving people, but accomplishments are more likely to be permanent when they are planned and carried out jointly even though it may take three or four times as long to achieve results.

As an example: it is very important to ascertain certain facts about a community before try-

ing to help solve a problem. One way to obtain facts is to have a survey made by experts from outside the community. These experts, having in mind an ideal, can quite quickly examine the community to see how closely it approaches perfection; then, they can, again with a considerable amount of speed and with great accuracy, record the comparison between present fact and ideal goal, and, finally, they can draw conclusions and make recommendations based upon their expert knowledge. In certain circumstances, and to meet the needs of certain communities, this kind of survey is useful and valuable. But sometimes the experts leave the community nothing more than a list of improvements which it should make to bring itself closer to the ideal. What happens then? The reaction, more often thought than stated, is very likely to be: "So these experts have examined us under their microscope and have found out that we ought to do thus and so. Why should they tell us how to run our town? They simply do not understand our situation. If they think such and such should be done, let them do it. We like our town as it is, and no imported expert can tell us otherwise."

But there is another way to conduct a survey, or in any event there are certain things a community can and should do before the experts come in. It takes longer and is more work for all concerned, but it is also more likely to produce lasting results; that is, the community can set up committees of its own citizens. They need not be experts, but they must be interested and intelligent individuals with a broad outlook. They should examine their community and find out the important facts about it. Having found them, they should study and decide whether or not the facts indicate correction. They should spend a lot of time at this job, and they may make some false starts. They should have professional assistance; this need not be an expert in the usual sense but a community organization worker who can provide the technical knowledge and act as the spark plug and generator for their machine. When their survey is complete, these citizens can make their recommendations to their fellow townsmen, and then the reaction of the community may well be: "We have looked at our town, and we find

that we need thus and so. We know that we need it, and we want to do something about it. We intend to see that something is done, and we do not intend to relax until it is done."

In Queens many people have been involved in planning ways to provide better service for the handicapped children in the community. Committees in which physicians, ministers, nurses, social workers, businessmen, housewives, and health educators worked and talked together have met over a period of years. Some of them were set up for specific purposes of relatively short term—for example, to plan the establishment of the diagnostic and evaluation division: Where should it be? What kind of a staff should it have? What should be the job of the various members of its staff? What children should it serve? How should they be served? Others were formed along more general lines—for instance, to work for the integration of service to handicapped children within the framework of existing casework and group work agencies: What services existed in Queens? How far were they serving handicapped children? Were they prepared to go further? What major gaps in service existed? How much understanding was there on the part of the staffs and lay leadership of those agencies as to what is meant by total rehabilitation? What was the best way to get more understanding?

As in the example given above of two ways to conduct a factfinding survey, there was a conscious choice made in Queens between two ways of serving handicapped children. It would have been possible to conduct a fund-raising campaign for a building to house treatment facilities, to employ expert campaigners, and to gather the necessary money. A new service, admittedly needed, would then have been superimposed on the existing community resources, without relation to any of them or coordination with their purposes. Instead of taking that more usual direction, those who planned the Queens Rehabilitation Program decided to spend time, effort, and money in pulling together the common interests of many people and organizations. By developing a general concern, providing a means for getting real understanding, and offering a channel for cooperative



effort, it was believed that the results would be more permanent and more securely based.

What has all this done for Harry? His physician knows that the boy needed the services of a skilled caseworker and that his physical adjustment would not progress very far until he and his parents were on better terms. The service which Harry needs is now available to him through a family casework agency, and he and his parents are consulting regularly with a staff member there. It was harder to get Harry's mother to accept the need for that than it was to make her understand the need for an artificial limb, but progress is being made. Similarly, it is harder to work with a group of agencies to the end that they develop services for themselves than it would have been to say, "You need a rehabilitation center. We will build it for you."

Working together for an aim which the community wants and knows it wants and needs, mobilizing all available resources of mind and heart and strength for a mutually understood goal—these are community organization methods. They are applicable, with suitable adjustments, anywhere, for any community, under public as well as private auspices.

Have the results justified this approach?

### Tangible and Intangible Results

Thus far the results have been of two kinds. One is tangible and concrete: A casework agency has inaugurated a special program for handicapped children integrated with its regular service to families and children.

A group-work agency has developed an experimental project to work with handicapped girls as a part of its general program. A special course for teachers who have handicapped children in their regular classes has been set up. School guidance counselors have been made acquainted with careers in health work and the variety of skills and interests which their pupils may develop in order to prepare for such careers. Two hundred children have been evaluated at the diagnostic and evaluation division in the Queens Hospital Center; many of them have been given muscle reeducation, have had appliances fitted, have been guided in the activities of daily living, or have had counseling service. Two other hospitals have also set up the beginnings of a treatment service.

The other kind of result is intangible and not capable of scientific measurement. For example, many people are more aware of the fact that handicapped children are children—that youngsters like Harry are not pathetic labora-

tory specimens of deformity but are children with feelings, reactions, emotions, and sensitivity. By the simple process of working together in committees on common problems, physicians, social workers, and other specialists have come to a greater acceptance of each other's skills; representatives of various groups have come to see that they have mutual concerns; people in different walks of life have arrived at an understanding of what each has to contribute to the

other and of what all have to give to the total community. The accomplishments of the program are their accomplishments, not the achievements of outsiders.

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### Surgeon General Burney



Dr. Leroy E. Burney, a career officer in the Public Health Service, became the eighth Surgeon General of the Public Health Service on August 8, 1956. He succeeds Dr. Leonard A. Scheele, who resigned to become president of the Warner-Chilcott Laboratories.

Preceding his appointment, which is subject to United States Senate confirmation, Dr. Burney was State health commissioner of Indiana and secretary of the Indiana State Board of Health, on detail from the Public Health Service from July 1, 1945, to August 1954. For the next 2 years he was Assistant Surgeon General and deputy chief of the Bureau of State Services of the Public Health Service. He had been assistant chief of the Division of State Relations in 1943 and 1944.

Dr. Burney established the first mobile venereal disease clinic service in Brunswick, Ga., in the late thirties. In 1945, on detail to the Navy for 5 months, he was sent overseas by the War Shipping Administration to devise effective control measures for communicable diseases, especially the venereal diseases, in various Mediterranean ports. On returning to the United States, he became director of the former Public Health Service District 4 (now a part of Region 7) at New Orleans.

Dr. Burney joined the Regular Corps of the Public Health Service in 1932 after completing his internship at the United States Marine Hospital in Chicago in 1931 and subsequently receiving an M. S. degree in public health at the Johns Hopkins University School of Public Health, which he attended on a Rockefeller fellowship in 1931 and 1932. He received his doctorate in medicine from Butler University and the bachelor of science degree from Indiana University.

Dr. Burney is a past president of the Association of State and Territorial Health Officers and has been an active member and officer of various State and national medical and public health associations. He was born at Burney, Ind., on December 31, 1906.



# tuberculosis:

## hospital or home care

Papers selected from the joint annual meetings  
of the National Tuberculosis Association, American  
Trudeau Society, and National Conference of  
Tuberculosis Workers, New York City, May 20-25, 1956

**T**HE IMPORTANT POTENTIAL source of new tuberculosis infection is the person with tuberculosis who is outside the control of a tuberculosis service. Even though progress in saving lives has overshadowed the tragedy of tuberculosis, progress in preventing the disease has been relatively slow: While mortality has declined, it appears that the decline in morbidity has not kept pace.

It seems that the heralded drugs—isoniazid, streptomycin, and para-aminosalicylic acid—may not kill all the tubercle bacilli in patients, even though these drugs effectively inhibit multiplication of the micro-organisms.

With the new drugs, and with infectiousness capable of being brought under control in a relatively short time, the stay in the hospital is shortened for many a patient. But even then, he must continue treatment at home. Without

utmost caution and continued drug treatment for a year or more, the disease may flare up, the patient becomes infectious again, and the circle of infection is set in motion once more.

Of major concern in tuberculosis control programs, the nonhospitalized patient is the subject of the Public Health Service survey reported by Dr. Robert J. Anderson at a special session of the National Tuberculosis Association annual conference, New York City, May 20-25, 1956. Dr. Anderson's report is reproduced on the following pages along with other selections from the conference: a paper on the social significance of chronic illness with a case history of home care for a tuberculosis patient by Lucille Smith, abridgments of papers by Ruth B. Taylor and Dr. Sabine M. Holin and associates, and abstracts of 10 papers selected for their interest to health department workers.

# The Nonhospitalized Tuberculosis Patient

## —Program Implications—

By ROBERT J. ANDERSON, M.D., HERBERT I. SAUER, VERNA SMITH,  
and DORIS E. ROBERTS, B.S., R.N.

**D**ESPITE the continuing decline in the mortality and new case rates from tuberculosis, a considerable problem still remains in the detection, treatment, and rehabilitation of the tuberculosis patient. The resistant nature of the problem is made manifest by the relatively slow decline in the morbidity rate. Consequently, the problem of treating and following active cases in the population is a stubborn challenge to all public health workers.

With the advent of the new antituberculosis drugs, the need for prolonged stay in hospitals has been diminished, and care of tuberculosis patients at home has become increasingly accepted. In the last few years there has been great concern about these patients. Several reasons underlie this concern: Many areas now have vacant tuberculosis beds which could be

used effectively for the treatment of tuberculosis; drugs are now available which may be given effectively to patients at home; and the need for intensive supervision of cases is more fully recognized.

Finding cases and supervising them once they are found are the two main activities in tuberculosis control. Finding cases is achieved by searching for the unknown cases not yet discovered by X-ray surveys or other means, for the unreported cases which have been diagnosed but are not as yet reported to the health department, and for the known cases which have become lost or are not followed because of lack of staff or other reasons.

Even today, when we are concentrating our attention upon known cases, we must recognize the importance of those which are unknown and unreported.

Provisional reports for 1955 show a total of approximately 100,000 newly reported cases for the continental United States alone, of which more than 75,000 were active or probably active, a rate of 46 cases per 100,000 population (fig. 1). The slow decline in newly reported cases of about 4 percent a year thus continues. Moreover, tuberculosis deaths show the smallest percentage decline since the introduction of chemotherapy almost a decade ago.

While the concern of this presentation is with known cases outside hospitals, we remain aware that constantly a large number of new cases is being added to the total load.

Past observations and empirical judgments form the basis for much of our present tuberculosis control programs. New facts and meas-

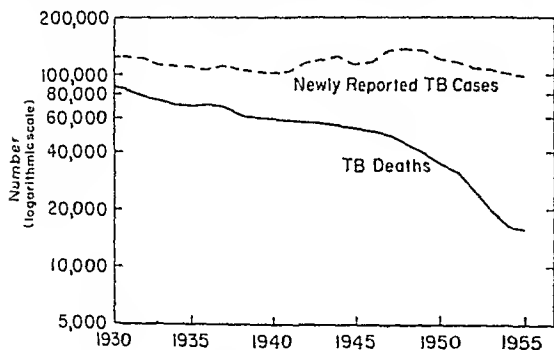
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*Dr. Anderson, assistant chief for operational research, Division of Special Health Services, Public Health Service, delivered this paper at the annual National Tuberculosis Association meeting, May 24, 1956. The other authors are all with the Tuberculosis Program, Division of Special Health Services, Public Health Service. Mr. Sauer is a statistician, Mrs. Smith, a health program adviser, and Miss Roberts is chief nursing consultant.*

*Important contributions to the study were made by Dr. Paul A. Pamplona, Genevieve S. Jones, Gladys M. Ray, Zella Bryant, Ruth B. Taylor, Dorothy E. Rogers, Sara B. Pearson, and Jewel G. Wyman, all with the Tuberculosis Program at the time.*

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**Figure 1. Newly reported tuberculosis cases and tuberculosis deaths, United States, 1930-55.**



urable characteristics of tuberculosis patients give us the foundation for realistic programs for the future in supervising cases after they are found. The Tuberculosis Program of the Public Health Service has been active in the past 2 years in a study of nonhospitalized tuberculosis cases known to health departments in 37 areas, representing the Nation, with a total population of almost 7 million. The latest information on these cases was obtained from physicians, clinics, hospitals, social workers, and public health nurses. Some of the information derived from this study supports our beliefs, and some of it demands a change in our concepts and approaches. A paper describing some of the general findings and the methodology of the study was published in February 1956 (1).

For example, it has been said that the number of known tuberculosis cases is increasing. Some have speculated that home care has replaced hospital care. Our study does not support these views. Undoubtedly, caseloads in some health departments are heavier because they are now supervising significant inactive cases for longer periods of time. But, in every area, the study shows that there were fewer known clinically active cases than had been estimated previously. This agrees with case register reports from 30 States, which show that between January 1, 1953, and January 1, 1955, there was a 6 percent decline in the number of hospitalized cases whereas there had been a 12 percent decline in the number of active cases at home. In other words, the number of active

cases at home declined twice as rapidly as the number hospitalized.

While our study sought, in particular, information about active cases at home, we had to review several times as many cases which were carried by the local health departments as significant for public health supervision. Cases selected for the study consisted of all cases classified as clinically active and presumably active and also all cases for which drug therapy is prescribed even though many drug cases are classified as inactive, arrested, or probably inactive. The activity classification of tuberculosis cases at home is shown in the following table.

Classification	Number	Percent
Active -----	1,896	60
Presumably active-----	376	12
Inactive with drug therapy-----	887	28
Total -----	3,159	100

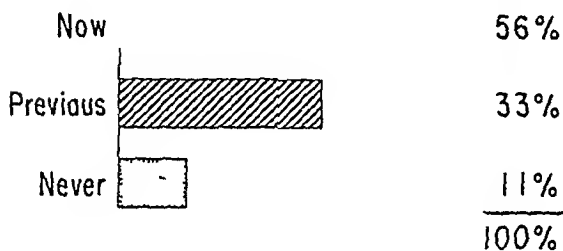
Those cases called "presumably active" consist chiefly of patients whose latest clinical diagnosis was "active" or "probably active" tuberculosis although this diagnosis was at least a year old at the time of the study. Also in the "presumably active" group are all cases classified as "arrested with positive bacteriological status." Technically, the 1950 Diagnostic Standards of the American Trudeau Society stated that arrested cases may, under specified conditions, have positive bacteriological findings. Actually, physicians seldom classified positive cases as arrested. In this study of more than 3,000 cases, only 70 cases were listed as arrested with positive bacteriological findings. Since these cases are of public health importance, they were included in this study. Incidentally, the small number of such cases found indicates the wisdom of eliminating this category from diagnostic standards.

### History of Hospitalization

We have all wondered to what extent home care is replacing hospitalization or what proportion of tuberculosis patients have ever been hospitalized. Our study provides factual answers to these questions derived from the ex-

periences of more than 7,000 patients in the 37 areas. Several years ago (2a), we found that less than half of the known cases were hospitalized. This study reveals that more than half, or 56 percent, are hospitalized as of the census date and that most of the patients at home today have a history of hospitalization. Eighty-nine percent of the tuberculosis patients either were hospitalized or had been hospitalized (fig. 2). Thus, we are unable to demonstrate any marked trend toward substituting home care for hospitalization. We do recognize a very marked trend toward supplementing hospitalization with a substantial amount of chemotherapy at home.

Figure 2. Hospitalization history of tuberculosis cases.



While 56 percent of the known significant cases were hospitalized as of the census date, there was some variation from area to area, with the large cities having 61 percent of their patients hospitalized, and the nonmetropolitan areas, largely rural, having only 46 percent hospitalized. These percentages are shown:

	Percent
Cities 200,000 population and over.....	61
Metropolitan areas exclusive of large cities.....	52
Nonmetropolitan areas, largely rural.....	46

Thus, the areas with the fewest health department and clinical facilities have the lowest percentage of hospitalized patients and the highest percentage at home. An identical relationship exists for the proportion of patients who have been hospitalized at some time in the past: Large cities have the highest proportion ever hospitalized and rural areas the lowest. For each area except four small areas, three-quarters or more of the known patients either

Figure 3. Percentage of tuberculosis cases hospitalized, by age group.



were or had been hospitalized. This proportion of cases hospitalized has many interesting ramifications pertinent to tuberculosis control.

#### Age, Sex, and Race

Many tuberculosis hospital directors have said that the average age of their patients is increasing and that they now have many more older patients than in former years. Our study showed that, of those patients 65 years of age and over, a higher proportion are at home than of any other age group (fig. 3.) This difference by age was found to exist for women as well as for men and for rural areas as well as for urban. Because of the drop in newly reported cases in young people, the higher percentage of younger people hospitalized, and the higher proportion of reported cases in older age groups, we predict that the number of younger adults hospitalized will decline and that the number of older adults hospitalized will remain stationary, or in some instances, even increase.

Analysis of newly reported cases and deaths from tuberculosis have shown that more men have far advanced disease than do women and that the male death rate is more than twice the female death rate. With this knowledge, it was encouraging to find that a higher proportion of men than women are hospitalized (fig. 4). While reasonable success has been

Figure 4. Percentage of tuberculosis cases hospitalized, by sex.



achieved in getting men hospitalized, there has been less success in keeping them in the hospital. That is, of the men at home who had been hospitalized, almost half had been discharged against medical advice whereas of the women, less than 10 percent had been so discharged.

Nonwhite patients had a higher proportion of far advanced disease at the time of first report and also a higher death rate than white patients. Thus, it is also encouraging to learn that a higher proportion of nonwhite patients are hospitalized. Actually, only 51 percent of the white patients were hospitalized as of the census date while 64 percent of the nonwhite patients were hospitalized (fig. 5). This may be due in part to the fact that nonwhite patients, especially in the southern areas of the country, showed a slightly lower rate of leaving against medical advice than did white patients.

Figure 5. Percentage of tuberculosis cases hospitalized, by race.



These observations indicate that though we have tried to adapt hospitalization practices to meet the needs required by sex and race, we have not met needs in respect to age.

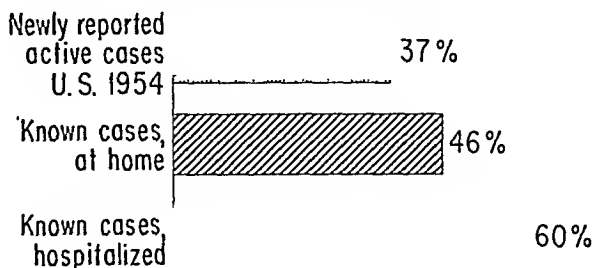
#### Diseases and Conditions

Tuberculosis patients at home had a wide range of diseases and conditions coexisting with tuberculosis. Slightly more than one-fourth of the patients had one or more coexisting diseases. In 6 percent, alcoholism coexisted with tuberculosis. Approximately 3 percent were recognized as having diabetes and a similar proportion as having cardiovascular disease.

#### Extent of Disease

Of the nonhospitalized cases in which the extent of disease was specified, almost half were far advanced as compared with 60 percent

Figure 6. Percentage of tuberculosis cases with far advanced disease.

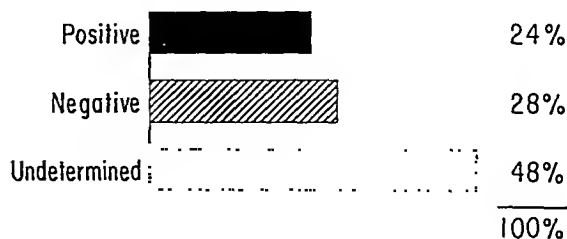


far advanced on admission among the hospitalized cases (fig. 6). Each of these groups contains a substantially higher proportion of far advanced cases than the newly reported active cases. This we would expect because of the usual prompt response of minimal cases to therapy. The extent of disease was about the same for cases from rural areas, as compared with those from the large cities and suburbs.

#### Bacteriological Status

The seriousness of the tuberculosis problem is reflected by the infectiousness, or bacteriological status, of the cases. Based upon the best information available to health departments, clinics, and public health nurses supervising these cases, the item of first note is the fact that no bacteriological examinations were available for half of the active cases within the 6 months preceding the census date even though a very substantial proportion of these were positive when last examined (fig. 7). In addition, one-fourth of the active and presumably active cases were bacteriologically positive within 6 months of the study date. Comparatively few of the

Figure 7. Bacteriological status in last 6 months, active cases at home.



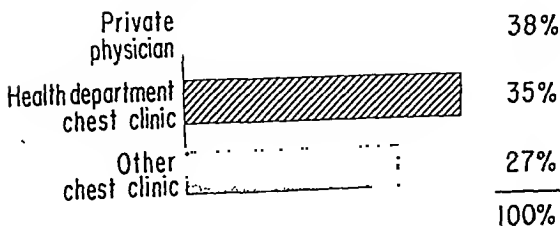
persons with unknown bacteriological status were newly reported cases; almost half had been known to the health department for 3 years or more. A slightly higher proportion of the positive sputum cases had been hospitalized than had the negative cases.

### Supervision and Treatment

Several years ago (26), we pointed out that many health departments do not maintain current information about the supervision and activity classification of their cases. In this study, of those classified on the case register as clinically active cases at home, 35 to 40 percent were found to be dead, hospitalized, moved away, lost, or no longer active. Therefore, they were removed from the group of "known active cases at home." Then, a check on the activity of cases classified as "activity undetermined" and a search for cases from other records resulted in adding almost 10 percent to the "known active cases at home." We reassert that health departments frequently do not know about the current supervision and activity of their cases and do not maintain adequate case registers. This deficiency might well be considered by those who are contemplating the addition of a register for tuberculin reactors.

Even though a substantial portion of the cases were thus excluded, the remaining active and presumably active cases were not all under medical supervision. In fact, almost one-fourth were under no known medical supervision. Those under supervision were about equally divided between private physicians, health department clinics, and all other sources of supervision (fig. 8).

Figure 8. Medical supervision of active cases with supervision known.



In spite of this inadequate knowledge about tuberculosis patients, health departments have made progress in the supervision of cases. Large numbers of inactive and probably inactive as well as active cases are receiving drug therapy at home, and the administering of such treatment programs requires much more work per patient than formerly. Even though the number of active cases at home has decreased somewhat, health departments are generally expending more effort on tuberculosis control. In fact, one large city health department reports that one-third of all nursing visits were made for tuberculosis. This is understandable when one recognizes that streptomycin was given, either alone or in combination with other drugs, to two-thirds of all the patients on drug therapy.

Drug therapy was prescribed for less than half of the active and presumably active cases at home. In view of the widespread interest in giving drug therapy to patients at home, we hoped that this proportion would be much larger. The low ratio results from several factors: First, some physicians so firmly believe that active tuberculosis cases must be in a hospital that they will not prescribe drugs to non-hospitalized patients. Second, almost one-fourth of the active and presumably active cases are not under medical supervision. Third, in some areas, medical societies, health departments, and tuberculosis associations have not developed treatment services for patients who are unable to pay for private care.

As might be expected, the recent hospital discharges showed the highest proportion of patients who had drug therapy prescribed while those discharged for a longer period of time and those never hospitalized showed lower proportions.

We have used the phrase "drug therapy prescribed" quite deliberately because giving a prescription is not necessarily synonymous with the patient's actually taking the medicine. In fact, available information gave evidence that, of the patients with drug therapy prescribed, 12 percent were not fully following their prescriptions.

The active cases with drugs prescribed also

generally had bed rest recommended while, of those without drugs prescribed, less than half had bed rest recommended. The inactive and arrested cases with drug therapy were more likely to have rest prescribed than were the active cases without drug therapy.

### Nursing Service

Our study confirms that there are more medical and public health nursing services available in cities and densely populated areas than in rural areas. Almost one-half of the population in rural areas had no readily available chest clinics; 10 percent had no public health nursing services. In the areas where nursing services are available, three-fourths of the population had 1 nurse serving more than 10,000 population; 8 percent had 1 nurse to more than 25,000 people. To bring nursing services to recommended standards would require more than a doubling of staffs. With few exceptions, the nurses carried a generalized public health nursing service.

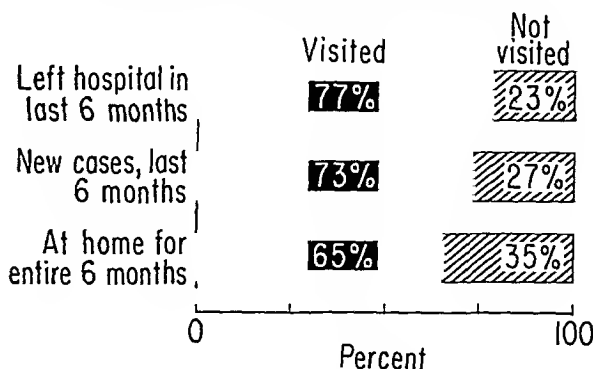
Therefore, it is somewhat surprising to find that public health nurses had made home visits to 69 percent of the nonhospitalized tuberculosis patients during the 6 months preceding the study.

However, it is significant that one-third of the patients seen at home were visited only once during the 6-month period. This was true for both the active and presumably active cases and for those with inactive disease on chemotherapy. Seventeen percent of the patients were visited more than 10 times in 6 months.

	Percent
1 visit only.....	34
2-9 visits.....	49
10-154 visits.....	17
Total.....	100

For many years it has been recommended that high priority for nursing service be given to patients newly reported or recently discharged from the hospital. We found that practice quite consistently follows this policy for public health nursing. Visits had been made to three-fourths of the patients discharged from hos-

Figure 9. Percentage of cases visited by a public health nurse within last 6 months.



pitals within 6 months and to three-fourths of the new cases reported to health departments (fig. 9).

Let us consider the one-third of all study patients who received no public health nursing service at home. The majority of these persons were not considered in need of service. One-fourth had never been referred for service, and physicians requested no nursing service for 8 percent.

	Percent
Service not indicated.....	33
Never referred.....	28
Physician requested no visits.....	8
No service available.....	7
All other reasons.....	24
Total.....	100

Some of these patients were under the care of the hospital or sanatorium outpatient department. The largest percentage were under the care of private physicians. Almost 200 of the patients who were not visited at home had unknown medical supervision or none at all.

One of the most serious deficiencies of programs in general is the lack of referral of patients and the transfer of information between physicians, hospitals, laboratories, social agencies, and health departments. Many health departments do not query private physicians periodically to ascertain current diagnoses or to establish whether the patient is still under care. Frequently, reports of laboratory examinations are not sent to the public health nurses giving care to the patient. Many hospitals do not include in their reports to the health department

the diagnosis, sputum status, type of discharge, or recommendations for continued therapy. Many health departments do not know which patients are receiving help from social agencies, and frequently the social agencies do not know which patients in their caseloads have a tuberculosis problem. It is obvious that such practices as these result in disjointed and inadequate utilization of the community services available to patients and their families.

## Social Aspects

Fairly widespread impressions have grown up that tuberculosis patients are predominantly social misfits, especially skidrow alcoholics. Because of the complexity of study of such matters, social data were collected only on certain basic factors such as marital status, family composition, major social problems.

### *Marital Status*

More than half the patients in the study were married. This is approximately the same distribution as the United States census population of 1950. Thus, contrary to a common impression, tuberculosis is not just a problem of unattached men.

### *Composition of the Family*

Of all active and presumably active cases at home, about 20 percent of the patients have children in the home under 5 years old. About half of the families with small children in the home have 2 or more children in this age group. Almost half of the patients at home did not have a room alone.

It is not necessary to elaborate on the obvious public health import of these findings. Because of the frequent report of problems in family relationships as well as financial and other social problems, we assume that some of these homes were not ideal settings for recovery. Criteria for homes suitable for treatment of patients with active tuberculosis have not been adequately developed. Furthermore, the very small proportion of patients receiving the broad services of organized home care programs indicates the need for a more extensive investiga-

tion and careful evaluation of the social situation of nonhospitalized tuberculosis patients.

### *Social Problems*

About 46 percent of the patients on home care were reported as having major social problems.

	Percent
Practical needs.....	21
Emotional needs .....	25
Unreported.....	15
No major problems.....	39

Total.....	100
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The types of problems fell into two broad categories: (a) such practical matters as insufficient income or inadequate housing, and (b) emotional areas relating to the patient's reactions to his illness and relationships between members of his family. The cases were almost equally divided according to these major types; however, there were a number of instances in which multiple problems existed.

Most of the patients who left against medical advice were included in the category of patients with social problems. We believe that for a large number of the patients who gave personal preference as the predominating reason for their rejection of hospitalization, social problems underlay their resistance.

The extent to which patients were receiving social service was analyzed. Of those patients reported as having a social problem, over 60 percent were not receiving social services of any type.

	Percent
No service.....	62
Public welfare.....	20
All other agencies.....	14
Unknown.....	4

Total.....	100
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Approximately 20 percent had received service from a department of public welfare. The remaining 18 percent received service from other agencies and from medical social workers in health departments. Only 17 percent of the patients at home were receiving financial assistance from any agency. Generally, public assistance did not include grants for medical



costs since most social agencies consider the care of tuberculosis to be the responsibility of medical and public health agencies. Financial problems were often encountered in relation to the costs of medical care, especially the purchase of drugs when these are not provided free.

The majority of the patients and families who were being helped financially were receiving assistance from public welfare agencies. Some welfare departments consider the determination of eligibility and the provision of grants to be their full responsibility. Even when these agencies accept a broader responsibility, lack of trained staff and the usually large caseloads often limit the extent to which they provide casework services.

The greatest concentration of social agencies was found in metropolitan areas. However, it was of particular interest to discover that 80 percent of the study population in rural areas had no social services except for those provided by departments of public welfare.

### *Alcoholism*

Special attention was paid to the extent of alcoholism among the nonhospitalized patients since this condition is generally considered an important factor in tuberculosis. The term "alcoholism" was listed by health department staff for patients whose drinking habits were considered a problem by the patient, the family, or the community. In only 6 percent of cases was alcoholism reported as a coexisting disease.

Approximately 11 percent of the men over 35 years were classified as alcoholic. Although the percentage of married persons classified as alcoholic is lower than that of either the single, separated, divorced, or widowed patients, the number of married alcoholic patients was largest since the majority of study cases were married. Nearly all of the patients designated as alcoholics had been hospitalized, but three-fourths left against medical advice. The public health implications are apparent.

We recognize the possibility that some of the hospitalized alcoholics may leave the sanatorium and disappear and thus not be available

for counting in our study. However, a similar low proportion has been found in other recent studies made by the Public Health Service Tuberculosis Program. Even so, we also recognize the importance of this problem in the individual patient.

### **Conclusions**

Our study of unhospitalized tuberculosis patients shows that they are, in most respects, quite like other people. Probably the one most important result that the study points out is the serious limitations of tuberculosis programs for the care and supervision of known cases. Consequently, it gives us a guide for the improvement of these programs.

If we believe it is important to tuberculosis control to have precise, current information about tuberculosis patients who are in need of intensive care and supervision, and if we believe that adequate treatment of these patients determines, to a large extent, the effectiveness of disease prevention and control, the study findings disabuse us of complacency.

More specifically, the study delineates certain definite areas of action in which improvements must be made.

1. Precise information must be maintained about the current medical and social status of tuberculosis patients, their families, and their environment.

2. Health departments must summarize such current information to evaluate tuberculosis control problems and to plan programs on the basis of local needs.

3. Closely integrated service programs must be provided for diagnosis, treatment, social service, and public health supervision of patients.

4. To this end, efficient communication and exchange of information are required of health departments, private physicians, laboratories, hospitals, clinics, and other groups and agencies.

5. While private physicians need education and consultation on the techniques of diagnosis and treatment, there is an equal need for obtaining their understanding of the importance

of public health supervision for patients under their care.

6. Standards for selection of patients to be treated at home and in hospitals should be established, based on patients' needs and services available locally.

In closing, we feel that the study has succeeded in confirming, replacing, and reversing many generalizations concerning tuberculosis.

We have tried to point the way to future action in the community.

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- (2) Anderson, R. J., Sauer, H. I., and Robertson, R. L.: Tuberculosis cases known to health departments. *Pub. Health Rep.* 68: 641-646, July 1943, (a) p. 643; (b) p. 644.

## The Social Significance of Chronic Illness

By LUCILLE M. SMITH

EVERY PATIENT with tuberculosis, like every patient with a long-term illness, has one need which overrides all others: to be looked upon as an individual, a whole person—not a disease or a stage of a disease or the focus of a program. And his identification as a person must, of course, be specifically related to his family and to the community of which he has been and is a part.

Other needs of care arise from the nature of the illness as distinguished from the characteristics of the individual. Tuberculosis, although still essentially a chronic disease, combines some of the patterns of both acute and chronic illness. The new therapies have introduced some possibilities for fairly rapid changes in the

patient's physical status; he now may experience marked improvement in weeks instead of years. Yet, exacerbations and remissions may occur, and treatment must be modified accordingly. Thus, the patient's reactions and responses to his condition are likely to be in a state of flux, and the care he receives must accommodate to this flux.

How extensive is the variety of services that long-term patients require? A committee at the 1954 National Conference on Care of the Long-Term Patient listed 30 needs, several, or even all, of which a long-term patient will require while at home, or while in a hospital or some other type of institution. This list shows not only the complexity of the patient's needs but the formidable problem of community organization required to assure ready availability of the service indicated (see inset).

We need to appreciate fully that the entire problem of long-term care is not a collection of separate problems to be solved one by one in simple progression. For the community, as for the individual, long-term illness presents a complex of needs so interrelated that many require simultaneous attention. And simultaneous attention is possible only if the

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*Mrs. Smith, chief, Health Services Organization Branch, Division of Public Health Methods, Public Health Service, presented this paper at the annual meeting of the National Tuberculosis Association in New York City, May 23, 1956. Extensive use has been made of an analysis of the major elements in long-term care from chapter 1 of "Care of the Long-Term Patient," a report of the Commission on Chronic Illness to be published shortly.*

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## 30 Needs of Long-Term Patients

Medical supervision	Sheltered work, at home or elsewhere
Drug and diet therapy	Personal adjustment training
X-ray therapy	Homemaker service
Surgery	Transportation
Psychiatric treatment	Financial aid
Rehabilitation	Assistance in obtaining adequate housing
Dental treatment	Foster home care
Social service	Legal aid
Bedside nursing	Convalescent care under medical supervision
Physical therapy	Custodial care
Appliances	Counseling to modify the family's and the patient's attitude toward chronic illness
Training in the use of appliances	Friendly visitors or volunteer corps
Occupational therapy	
Training in self-care	
Vocational counseling	
Education	
Religious opportunities	
Vocational training	

major elements of the problem are widely recognized and their relationship understood.

## Elements of Long-Term Care

First of all, there is the relationship of tuberculosis and general medical care: Each requires integration with the other. Second, rehabilitation must be incorporated within all phases of care. Third, we must genuinely ask ourselves: Is institutionalization the primary solution to the problem? The fourth major element concerns mental health: How can we refocus the objectives of both tuberculosis and mental institutions so that adequate mental health services are available in tuberculosis hospitals and adequate care for tuberculosis in mental hospitals? Fifth, how can we improve and extend present, and develop new, means of financing long-term care? The sixth element is that of increasing the numbers of trained personnel and improving the quality of their training. Seventh, every community, and local, State, and national health and welfare organization needs to improve ways to coordinate facilities and services for tuberculosis patients. Eighth, there is need of accelerating improve-

ments in attitudes toward tuberculosis, and, indeed, toward all long-term illness. Finally, broad measures are needed to produce additional facts on the extent of the problem and the utilization of medical care resources for long-term care.

## Integration With General Medical Care

Medical care has been geared to short-term illness except in special facilities devoted to particular categories of long-term illness, such as tuberculosis.

A general hospital, for example, is likely to operate at a tempo primarily designed for emergencies, a tempo quite unsuited to the chronically ill. Further, professional interest tends to gravitate to the acutely ill except in hospitals with a well-rounded and active teaching program. Attention to the nonacute phases of chronic illness is inclined to be transient and minimal, and professional services to the long-term patient are often meager. In the past, this has resulted in the all too familiar practice of excluding tuberculosis patients from general hospitals. Sometimes, unhappily, it has resulted in substandard tuberculosis care in those few general hospitals which do accept such patients.

But one should not assume that neglect of long-term illness will be corrected by further separation of the long-term patient from general medical care. On the contrary, prevention and care of chronic illness should be an integral part of general medical care.

An encouraging move in this direction is the slowly developing program for routine chest X-rays of all persons admitted to general hospitals. About 24 percent of all general hospitals have such programs, according to reports to the American Hospital Association for 1954 (1). If this program is used to detect early tuberculosis among persons not yet aware of symptoms, it will be a valuable means of integrating general and long-term care. If, however, the program is used to expedite the transfer from the general hospital of all patients

newly discovered to have tuberculosis, it will serve further to separate the two.

### Rehabilitation

Failures with regard to rehabilitation are of two kinds.

Few think of rehabilitation as an integral part of care. Few discern its important implications for prevention. Rather, it is conceived of as a definitive action to be tacked on at the end of definitive medical care.

Moreover, many people think that rehabilitation is necessarily expensive, that it calls for the elaborate equipment and specially trained personnel of the rehabilitation center. For some patients, to be sure, it is. But such outstanding authorities as Rusk and Kessler repeatedly assert that much rehabilitation is accomplished by simple methods—methods based on an understanding of man's emotional make-up. Nevertheless, it is still commonplace for a patient with tuberculosis to be hurried into a sanatorium before satisfactory plans are made for the support of his wife and children, before he has been assured that his family has not contracted the disease, before he has had fully explained to him what his regimen is to be.

Suppose his disease is discovered in an occupational health survey in a factory where he has just got a job after a long period of unemployment. Probably he will resist violently an abrupt recommendation that he be hospitalized. If he has recently been promoted, or had some other long overdue good fortune, he will need time to become accustomed to the idea that he is in trouble.

If he enters the institution and finds that it has rigid and arbitrary visiting hours and that he has arrived just after one of them, he may suffer unnecessary anguish before he can see his wife again. Such incidents typify unnecessary hazards to restoration of his health.

These incidents represent not so much failure on the part of individual providers of health services, but faulty policy—in the welfare or health department, the factory, the hospital. They point up neglect of rehabilitation possibilities per se. They demonstrate failure to

recognize that rehabilitation can prevent further deterioration; that proper preventive measures often obviate the need for rehabilitation and reduce the need for treatment; that prevention, care, and rehabilitation are inseparably intertwined.

### Home Care Services

Institutional care as the solution to long-term care problems has long been overemphasized. Even though less than one-fourth of our long-term patients are in hospitals and other medical institutions, many who are in such places could be cared for as well or better at home. Construction of some additional medical treatment facilities is still needed, particularly for patients needing rehabilitative services and those whose need is primarily for skilled nursing care. But more and more beds for long-term care will not provide the care needed.

Private practitioners and administrators of general, tuberculosis, chronic, and mental hospitals verify this fact: There are in institutions large numbers of patients whose requirements for care could be better met in the home, if nursing and other services could be made easily available to them—a Gatch bed for the tuberculosis patient; someone to give him an intramuscular drug; someone to help him in and out of bed occasionally; someone to shop for the housewife with tuberculosis.

The story is repeated over and over. As soon as one important need of the patient develops that the family cannot meet, he is placed in a hospital or in some other institution, and then what happens? Once the admission occurs, his place in the home may be lost forever. The doctor and social worker who later try to help the patient and his family plan for his return find that the readjustments he must make are insuperable.

Home care is one antidote to overinstitutionalization. One of the most constructive steps a community can take is providing a generous measure of the services which will enable families to care for their own at home. Each community will need to determine for itself what services should be offered and by whom. The

most frequent and perhaps the most important service is that of the visiting nurse, providing bedside care. Other important home services would include social casework, physical and occupational therapy, homemaker service, friendly visitors, and the loan of wheelchairs, hospital beds, and bedside equipment. These services may or may not be integrated into a fully organized home care program; but if the services are easily available, if administrative obstacles to their use can be removed through skillful community organization and, if practitioners of medicine are fully informed about these services and will in fact make full use of them, then the community can make substantial progress in preventing unnecessary and unwise institutionalization.

A word of caution is indicated concerning the concept of home care. This phrase to some means simply care at home for the nonhospitalized tuberculosis patient. To others it means something more comprehensive, such as "organized programs having centralized responsibility for the administration and coordination of services to patients and for providing the minimum of medical, nursing, and social services, and essential drugs and supplies" (2a). Both kinds of home care have their place in a community. Of 11 organized home care programs in the study made by the Public Health Service and the Commission on Chronic Illness (2b), patients with tuberculosis were under care in 5.

## Example of Good Home Care

The following case shows how a good home care program, administered by a general hospital under Jewish auspices in a large midwestern city, has served a patient with tuberculosis.

Following X-ray examination in a mobile unit, Mrs. A., age 33, was told she had active pulmonary tuberculosis. The public health nurse in her followup visits was met with denial of the diagnosis. Mrs. A. adamantly refused to consider the necessity for care in a State sanatorium 240 miles away from home. Finally, she consented to discuss the possibilities

for care in the home care program of a private general hospital.

In discussion with the home care social worker, Mrs. A. continued to deny the diagnosis of tuberculosis. At the same time, however, she expressed her dual fears of infecting her young adopted sons, ages 5 and 7, if she remained near them, or of crippling them psychologically if she left them for an extended period for medical care.

Mrs. A. is an intelligent person of broad interests, a highly skilled commercial artist, whose primary interest is her family. She had experienced many complications in achieving the adoption of her two sons, brothers who had previously been in several homes. These youngsters had barely acquired a degree of security with their adopted parents. Mrs. A.'s husband, an auditor, had a position which often kept him away from home except for weekends. Their income was about \$5,000 a year. They were buying a 4-bedroom home in a suburb.

With trepidation, Mrs. A. decided to risk intensive study in the general hospital to see if she could be attended properly in the home care program. A 10-day study in the hospital revealed far advanced tuberculosis with cavitation in the left upper lobe. Sputum was positive. Treatment requirements included: regular medical supervision; complete bed rest in a room to herself with bathroom privileges; isolation, for example, no visitors in her bedroom; relief from all household responsibilities; and most important, full cooperation of the patient in following these requirements.

In this home care program, the medical chief, after staff conference, makes final judgment on the willingness and ability of his patient to give full cooperation. After much discussion with Mrs. A., he decided that she wanted to and would follow his recommendations at home.

The social worker with the family had found that Mr. A. and the children believed that they could live with Mrs. A. and help her follow medical recommendations. Physical arrangements in the home were excellent. A full-time homemaker—capable of managing both the household and the two children—was found to live in. The visiting nurse could reinforce

with home teaching the doctor's instructions. The social worker would visit regularly and be on call. The home care doctor would pay periodic visits to the home.

This patient went home from the hospital on October 1, 1954. The children had a small dining table in the hall outside her room. They had their meals at the same time she did. Their chairs were always in the same place for short periods of conversation. Her quiet periods coincided with their school hours and bedtime.

This was a limited type of life for a vital woman such as Mrs. A. By spring, she longed for her usual garden activities and friends. Her doctor began to authorize graduated activities. For example, she was permitted to have tea with some of her neighbors, who sat in the yard outside her window while she remained in her bed.

By August 1955, Mrs. A.'s sputum was negative. By November 1955, she was readmitted to the general hospital for chest surgery. A left upper lobectomy was performed. She continued to make excellent progress and in May 1956 was discharged from the home care program.

The strength and unity of this family have been greatly protected and preserved in this period of grave illness. Even so, the two children, as well as Mrs. A., are now overconscious of health. The children show some fear for their mother's health. She in turn does more for them at this time than most 8- and 10-year-olds need. The social worker in the home care program will continue to work with Mrs. A. to aid in her efforts to reach a better balance in helping her children achieve normal growth to independence.

For those who may be moved to explore the possibility of a home care program in their own communities, guidelines for establishing such programs are published by the Public Health Service and the Commission on Chronic Illness (2b).

### Mental Health

While prodigious sums are spent for maintenance of mental patients, comparatively little is spent on treatment and study of mental illness.

Many patients with a primary diagnosis, such as tuberculosis, also suffer mental illness. In fact, sooner or later most long-term patients develop emotional afflictions. In short, mental illness permeates the entire field of chronic illness. In mental hospitals there is too little treatment of tuberculosis; in tuberculosis hospitals, too little emphasis on psychiatric care. The major need for improving this situation is a vast increase in community mental health services and an overhaul of mental institutional services with an active program of therapy as the core of the program. Improvements in comprehensive care for tuberculosis patients also will moderate many of their mental stresses.

### Money

The financing of care for tuberculosis presents a paradox. Not enough money is being devoted to such care; yet a considerable portion of that which is spent is not used effectively. As the Commission on Chronic Illness says in its report, *Care of the Long-Term Patient (3a)*: "Because of inertia, outmoded practices persist; because of timidity, measures demonstrated to be practical in some communities are slow to spread to others; because of frugality, approaches are adopted that prove to be 'penny-wise and pound-foolish'; because of vested interests, the status quo is maintained when a fairly thoroughgoing realignment of methods of providing and financing services would be more economical. . . .

"As voluntary health insurance continues to grow, more money will be available for the care of those who can afford to pay the basic premiums. Trends are in the direction of extending coverage and modifying policies in ways that will benefit the long-term patient; but large groups of these patients are still excluded from the bulk of private insurance and from nonprofit voluntary prepayment plans."

The limitation of insurance on preexisting conditions is one example of an exclusion that adversely affects the patient with tuberculosis; another is the common 120-day limitation on hospital care.

"Government funds are frequently held to a parsimonious level, reflecting the traditional philosophy of providing minimum subsistence and care rather than reconstruction of the health of the person. All too often public monies are made available in ways that practically preclude their more effective use. The manner in which they can be spent may be so restricted by law that they can pay for some services but not necessarily the kind of service the patient needs. Government often waits until the patient is reduced to the level of public assistance, missing earlier opportunities to halt the deterioration of his health. This in spite of the fact that many programs which are adequately supported are demonstrating good results" (3b).

Although private charities cannot carry a major share of the operating costs of care of the long-term patient, their use of "venture" capital has been a unique contribution in developing counseling services, homemaker services, and home care programs. Such pilot demonstrations may be used to muster a greater degree of public support.

#### Personnel

For long-term care, probably the most serious personnel needs are: general practitioners; psychiatrists; specialists in pulmonary medicine and in physical medicine and rehabilitation; public health physicians; nurses, particularly the public health nurse giving bedside care and the practical nurse; trained attendants; medical and psychiatric social workers; occupational, physical, and speech therapists; and vocational counselors. Most of these shortages are not due primarily to insufficient capacity of professional schools. The schools which offer training for most types of the needed personnel report a lack of students.

A few facts on the availability of one class of needed personnel—the medical social worker—will suffice to illustrate the seriousness of these shortages. These facts are available from a joint study by three organizations: the American Hospital Association; the medical social work section of the National Association

of Social Workers; and the Public Health Service. It is to be published this fall.

One in every three hospitals for tuberculosis and other long-term patients has a social service department, but only 1 in 8 hospitals for short-term patients. Perhaps, for long-term patients this sounds reassuring. Nevertheless, the sober fact remains that 65 percent of the 410 tuberculosis hospitals have no social worker; 24 percent have only 1 worker; and only 7 percent have more than 3 social workers.

Considerably more patients receive social services in tuberculosis hospitals than in general hospitals. But even in the tuberculosis hospitals, only 35 percent of those in hospitals with social service departments receive this type of service; these amount to 20 percent of patients in all tuberculosis hospitals.

The proportion of graduate social service personnel is somewhat less in tuberculosis hospitals, 60 percent, as compared with 62 percent in general hospitals for short-term patients, and 73 percent in general hospitals for long-term patients.

Other findings suggest that social service departments in tuberculosis hospitals may not be as well integrated with other departments as are departments in general short-term and long-term hospitals. Conspicuous contrasts are shown by the participation of social work departments in such activities as meeting with hospital administrators and ward rounds. Seventy-one percent of the departments in tuberculosis hospitals had met with the hospital administrator, as contrasted with 90 percent in general long-term hospitals. On ward rounds: 27 percent of the departments in tuberculosis hospitals had participated in ward rounds, as contrasted with 62 percent in general long-term hospitals. Twenty-eight percent of the departments in tuberculosis hospitals make no reports to the hospital administrator as compared with 7 percent of each of the other types of hospitals.

With respect to specialty consultations, the proportion of departments having psychiatric and other medical specialty consultations is substantially smaller in tuberculosis hospitals than in the other types of hospitals.

These findings suggest the desirability of special efforts by voluntary and official agencies to strengthen existing administrative relationships through such measures as special studies, consultation, and institutes. The need for additional scholarship aid for both the first and second year of graduate training is equally obvious if the tuberculosis hospitals are to be adequately supplied with graduate social work staff.

Not only must the numbers of most health personnel be increased, but educational programs must be refocused to produce personnel who will be interested in and equipped to care for long-term illness. Education for most of these professions traditionally has been directed to acute illness and has been provided principally in a hospital setting. Interest and skill in serving patients at home need primary emphasis.

### Coordination of Services

Lack of coordination of services in some communities is greater than the lack of money. One cannot overemphasize the importance of good working relationships among diverse community agencies, facilities, and interests.

In recent years a promising start in coordination and integration has been made in many localities.

In a few scattered communities—Essex County, New Jersey; Chicago; Milwaukee; and San Francisco, for example—central services for the chronically ill have been established under voluntary auspices to advise patients, their families, and physicians on where various types of counseling and referral service can be obtained. People can be helped to examine various solutions for their problem, learn what and where various services are available, what they are likely to cost, and which services are available without charge or on a part-pay basis.

A single source of these counseling and referral services, however, is most unusual. Most victims of long-term illness must attempt to make contacts with a vast number of programs, agencies, and institutions before they can locate the specific service needed at a given time

and, if the cost is beyond their means, find a source of funds with which to pay.

Local tuberculosis associations can do much to help establish similar services in other communities. We have only begun to tap the possibility of joint financing by the voluntary health agencies of much needed community services, of which counseling and referral are but one example.

Another type of coordination is that which is possible nationally. The experience of the Commission on Chronic Illness is a notable example. Born of the wish of four national professional associations and the Public Health Service to make order out of various unrelated efforts to improve long-term care, the commission has concluded its brief but highly successful career. It is gratifying to see some of the forecasts of things to come. The American Medical Association, for instance, is now publishing the *Chronic Illness News Letter*, in connection with which it will also serve as an information center for the many inquiries which the *News Letter* stimulates.

A committee has been appointed to develop a program of research and education relating to the aging processes. This committee has already begun plans with the Public Health Service for ways to bring together State medical societies and State health departments on projects to improve the health of older people. Still another committee is reviewing the progress being made by the voluntary prepayment plans in extending coverage to the long-term patient.

In the field of rehabilitation, the American Medical Association has recently created an intra-association group, consisting of representatives of several of its councils, to look into the present status of rehabilitation, review existing programs and procedures, and suggest methods for improvement and coordination. Field work by the Council on Medical Service is already underway.

The American Hospital Association meanwhile has appointed a Committee on Chronic Illness in its Council on Professional Practice. The committee plans to publish new materials to (a) further accentuate the vital role of rehabilitation, (b) answer how-to-do-it questions



including those of financing the hospital care of the chronically ill, and (c) show examples of good programs in action.

The American Public Health Association and the American Public Welfare Association likewise are projecting programs in which the major objective is to achieve coordination of services and facilities—in itself an example of coordination.

## Attitudes

Attitudes toward long-term illness, warped for generations, are changing as its nature and the needs of its victims become understood and as methods of treatment are learned. Neglect and pessimism are being replaced by an aroused social conscience and by confidence in the value of treatment and rehabilitation. The change is not sufficiently rapid or extensive, of course, and it needs to be accelerated among persons in the health professions even more than among those in the general population.

In the past, misconceptions constituted the single most important block to changing attitudes. Because much long-term illness is painful, ugly, depressing, and costly, it is still a major feat to gain attention and a constructive attitude for its victims.

Nevertheless, negative ideas have yielded. Long-term illness is no longer commonly regarded as hopeless and the care of the long-term patient is becoming a successful undertaking.

## Need for Additional Facts

The final major element in the community's chronic illness program, the need for additional facts, should be first. Although most families are affected by it, we have no accurate up-to-date measure of the dimensions and various characteristics of long-term illness. Considerable research is being conducted on causes of the various chronic diseases and better measures for treatment, but little attention is given to studies of how best to apply what knowledge we already have.

Since 1949, the United States National Committee on Vital and Health Statistics has emphasized the need for more adequate informa-

tion on illness. In 1953 that group published a blueprint of the needs for statistics on illness in the general population (4). In addition to a few community studies, the Federal Government is now about to undertake a continuing health survey. Data collected on a sampling method will provide periodic estimates for the country as a whole and by regions on the prevalence and incidence of the major categories of sickness and disability.

The information obtained will include for each major disease and type of impairment "such things as number, age, sex, occupation of persons afflicted, the duration of disability, the amounts and types of medical or other services received for, or because of, the illness or disability, and ability to work or engage in other activities, for example, the ability to attend school in the case of a child, or, in the case of a housewife, ability to perform usual household duties" (5).

These surveys will provide facts much needed to comprehend the problem of chronic illness and to give direction to community plans for its solution.

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relationships between a patient and a member of the ward staff, conflicts between one member of the staff and one or more of the ward personnel can influence, adversely or positively, the individual's course of treatment in the hospital. The death of another patient, a fluctuation in the physician's level of interest, the waxing and waning in the intensity of nursing care are described as significant contributors to stress.

Other studies support the premise that factors within the hospital setting contribute significantly to unauthorized discharges. One analysis indicated that two-fifths of the patients who left did so mainly because of such factors. Predominating among reasons given for leaving were dissatisfaction with medical treatment, hospital rules and procedures, and with the attitude and amount of interest shown by hospital personnel. Next in order were lack of facilities or concern for treatment of other ailments, conflicting medical opinions, and the physician's refusal to discuss the patient's condition with him.

Coleman, writing in the *Journal of the American Public Health Association* (July 1955), observed that though some few tuberculous patients can only be helped by psychotherapy, the majority can be helped by psychiatrically oriented physicians, nurses, and social workers. To these statements I would add my own conviction, notwithstanding the importance of specialized training, that the personal qualities of sympathy, objectivity, courtesy, and warmth are primary requisites for a professional worker.

The foregoing comments may be summarized as follows:

1. Granted that personality or social problems may lead to a patient's refusal to follow medical advice, we must not overlook the possibility of other contributing factors. These are primarily attitudes of hospital personnel toward patients and the willingness of such personnel to adapt administrative procedures to the needs of the patients. Flexibility or change is not always possible immediately, but professional personnel sometimes forget that institutions are for the patients, not structures in which the patient is only an incidental entity.

2. Responsibility for the welfare of the patient is shared by all persons in the hospital and by others on the outside. Some emotional outbursts may be expected to occur at any stage in any long-term illness. We cannot always avoid such outbursts. We should, however, in addition to providing the best of medical care, direct our efforts toward understanding the patient, being alert to possible pressures, trying to relieve the pressures before they become critical, providing an outlet for the expression of feelings without fear of recrimination, helping him directly or indirectly in resolving difficulties which create concern, and providing in general a comfortable atmosphere in which he can recuperate.

### The Patient at Home

Before discussing ways of helping the patient who refuses hospitalization, let us face the fact that the controversy among medical authorities over whether a patient with active tuberculosis belongs at home or in a hospital has undoubtedly reached the patients. It is not surprising that they are confused about the importance of institutional care. The impressions of professional people working with the tuberculous patient are that he may resist hospitalization because he believes it no longer necessary.

Not to pursue this subject further, I shall cite two experiences which independently led to the same conclusion although they occurred several thousand miles apart and involved workers who were never in communication with each other.

Fifty recalcitrant patients were referred to a medical social worker in one health department and 50 to a sanitarian in another, to determine how these departments could persuade patients to accept the hospitalization they had refused. Both workers concluded that only 2 or 3 of the patients were genuinely recalcitrant. The remainder responded to the genuine interest displayed and help received. The 47 or 48 patients who subsequently accepted hospitalization voluntarily represented as many different situations and were alike only in that they were not actually recalcitrant. It follows then that we often label patients resistant when they

# Patients Who Disregard Medical Recommendations



The tuberculosis patient who refuses to follow medical advice is a subject of major concern. It is frequently assumed that "uncooperative" patients are of certain prototypes and that the unattached, transient, male alcoholic is the most numerous. Another widespread assumption is that most nonconforming patients are inadequate personalities who react as they do because of economic and social pressures. Compulsory isolation is often considered to be the only effective method of management.

Though some aspects of this problem—primarily, why patients leave hospitals against medical advice—have received intensive study, relatively little research has been directed to learning why other patients with similar circumstances are willing to accept hospitalization; to determining whether patients at home follow medical instructions; or to developing means of helping patients who refuse to stay in the hospital. The various research projects completed in recent years have at least provided some knowledge which bears upon current assumptions and which suggests ways of helping the problem patient.

One major finding is that there is no predominating type of recalcitrant any more than there is a predominating cause for his behavior. Resistance to restricted activity, to medical authority, to isolation from family and social contacts, as well as fear of boredom, are normal responses in an individual accustomed to controlling his own destiny.

Some patients may acquiesce for a long time only to rebel in a crisis. Others may deliberately break discipline because they project their

hostility toward tuberculosis onto the hospital or society. Most have plenty of time to brood over their worries. The patient who has two diseases, alcoholism and tuberculosis, and the really mentally or emotionally disturbed patient who requires psychiatric as well as medical treatment, add to the complexity of the pattern.

The first step for devising ways of helping patients who do not follow medical recommendations is to identify the contributing factors. A further implication is that the method of helping must be adapted to the special needs of each individual.

My comments will be directed to a discussion of patients who leave the hospital against advice and patients who resist entering. Other forms of resistance, both in and out of the hospital, include refusal to permit surgery, failure to follow orders for restricted activity, evasion of medical supervision, working without medical approval, and refusal to take drugs. The same principles apply in all of these problems.

## The Patient in the Hospital

Some research projects describe a method of predicting potential discharges against medical advice, and psychologists have concluded that these patients can be helped if kept under close surveillance. My own feeling is that any patient is a potential recalcitrant under circumstances of stress. Hospital patients react to stress situations more vigorously than they would to similar stimuli outside the institution. Society must help the tuberculosis patient withstand the pressures to which he is subjected, for the sake of his own recovery as well as for the protection of those he might infect. Its responsibility for protecting him against needless irritations is even greater. On occasion, hospital and health personnel unwittingly contribute to the many pressures which may push the individual beyond his powers of endurance.

Higgins and Kaplan in the *Journal of the American Medical Association* (May 1953) shattered some of the illusions about the hospital as a place of refuge and security. Their study showed that relationships among patients,

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health gains. There must be a willingness to find ways of adapting such practices imaginatively. Insistence upon conformity to a preconceived set of standards may only thwart all other efforts. Respect for the individual and his right to be different is fundamental in all social relationships, and especially when the individual is a tuberculosis patient.

## Pulmonary Nodules Found In Cleveland Survey



To provide accurate rates on the frequency with which malignancy is found among solitary nodules in the lung parenchyma, a study was made of 666 persons in the Cleveland 1949 chest survey whose X-ray film revealed a nodule that was roughly spherical or lobulated in shape, fairly well circumscribed, at least 1 cm. in one diameter, and not obviously calcified. In the mass survey 673,218 chest X-rays were taken.

Followup, which included pertinent interval history and further X-rays, began 5 years after the survey, in March 1954, and continued through June 1955. Only 3.3 percent were of completely unknown status at the end of the observation period. The average followup time for those with complete followup was 5 years and 3 months.

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Nodules occurred  $5\frac{1}{2}$  times more frequently among older persons aged 55-64 (about age 60) than in persons aged 25-34 (about age 30) and more often in white than in nonwhite persons. Among women the frequency rate was 0.87 per 1,000. The male rate of 1.12 was 30 percent higher. Neither the race or sex differences are due to age distribution of the population. Response to the X-ray survey was poorer among the older age groups in 1949 than among the younger age groups, but even if the response had been better and the study had included more persons, there is no reason to believe that the age-specific nodule frequency rate would have been different.

In 85.4 percent of the study population, no definite diagnosis had been established at the end of 5 years. Only 3.0 percent of the nodules were proved malignant, and 9.0 percent were proved to be or very probably were of tuberculous etiology; 2.6 percent of the patients had lesions of other etiology. No diagnosis, not even a suspected diagnosis, was made in 74.7 percent of the patients with nodules. However, in 10.7 percent, tuberculosis and cancer were presumed, and it seemed quite likely that malignancy may develop in a certain number of nodules of unproved etiology. Most of the nodules were diagnosed early.

No malignancies occurred in patients under 45 years of age. In all, there were 19 cases of cancer and 1 of Hodgkin's disease. Sixteen patients were male and 4 were female. Pulmonary resection was performed in 7 patients with cancer. Three of the seven were alive at the end of the study. Definite or probable calcification was found in 181 nodules, but none of these proved to be malignant. None of these nodules had appeared on the original film. Even if the persons least likely to have malignant nodules are excluded from consideration, the cancer rate is only 9.9 percent (see table).

The shape of the nodule appeared to have no prognostic significance, but the size appeared to be of considerable importance. In 43 persons the nodules were 4 cm. in size or larger; 10 of the 43 were subsequently shown to have malignancy. Roughly half of the malignancies were in persons with the larger nodule, and in

simply need more, or better, or different types of help in understanding and accepting medical recommendations.

Many dedicated health personnel have expressed feelings of frustration about the problems presented by patients who will not follow medical recommendations. They may pass more stringent laws. They may work with the courts to insure that forcible hospitalization will be approved when cases come up for consideration. They may withhold drugs or clinic services. They may develop locked wards or jail facilities. And they may use, sometimes reluctantly, all of the authority vested in their positions to protect the public health. Because the majority of patients in direct contact with health departments are in the lowest economic stratum, the impression has grown that the tuberculous belong to the socially inadequate segment of society. A corollary appears to be that they must therefore be handled by authoritative means. There are certain dangers inherent in this philosophy. To the extent that we stigmatize and use coercion on patients, the more likely they are to "go underground."

Actually, our studies have revealed an insignificant proportion of any predominating type of tuberculous patients, recalcitrants or otherwise. There are, of course, cases in which force alone seems indicated. Some psychiatrists believe that patients who are at odds with society can best be helped by authoritative, nonpunitive handling and that such patients receive real benefit from isolation in a facility especially adapted to their particular needs. Many an intractable alcoholic who has walked out of numerous hospitals responds to enforced treatment when it is tempered with sympathetic attention and the full gamut of psychiatric, social, and rehabilitation services.

Undoubtedly, we already have most of the answers to this problem of interpersonal relationships between patients and staff. The hiatus is between knowledge and its application. Since no two patients and no two situations are really alike, generalizations are often dangerous. Even so, I shall make a few generalizations in conclusion.

1. One might well expand Tollen's remark that "the prevention of irregular discharge begins at the start of treatment," and say that the prevention of resistance to medical recommendations begins early in the patient's life. However, because human nature has the capacity to change, each new experience can be positive or negative in its impact, and even well-adjusted people are not immune to overwhelming pressures. Those who have certain emotional inadequacies can also be helped through a crisis situation. When tuberculosis is suspected, an opportunity is present for influencing the patient's attitudes by the way in which his condition is interpreted to him. As he progresses through medical treatment, each new situation either facilitates or hinders the adjustment according to the way in which this crisis is met.

2. Compliance with medical recommendations is not always synonymous with satisfactory adjustment. The impact of the emotions on the progress of tuberculosis is well established. The acting out of resistance may upset the staff but benefit the patient. Attempts to impose certain standards of behavior on patients increase resentment. Acceptance, on the other hand, of these reactions as normal, and of patients as people with a right to express their opinions lessens their need to fight persons who are helping them fight their disease.

3. Skilled professional staff of the several disciplines should be available to provide their interrelated services throughout the course of diagnosis, treatment, and rehabilitation. The assistance of family members and friends must be mobilized to lend support to the patient and facilitate his acceptance of needed care. Community resources should be accessible, and their staffs should have an adequate understanding of the medical and social implications of the disease and of its significance to the individual patient.

4. Special problems often require the development of new skills. Cultural patterns must be understood. When an Indian is hospitalized hundreds of miles from his hogan, his photograph is sent periodically to relatives to show

Choice of administering either the Mantoux test or the Vollmer patch test is made by the county medical society.

To assure statistical information from each testing program, a key punchcard has been devised for machine tabulation. Use of the punchcard is a prerequisite of certification. The program cost includes punching and tabulating costs. The cards give data on age, race, sex, occupation; whether the Mantoux or patch test was used; and whether the reactions were negative, positive, or converter.

A statistical summary of more than 200 schools which have already been certified, including the number of new cases discovered, is included in the full paper.

Once the number of tuberculin reactors in a community is determined, this comparatively small group lends itself to practical reexamination at frequent intervals. It has been proposed that a registry of tuberculin reactors be established in Jones County. As time goes on, other reactors can be added to the list. Plans can be made to X-ray periodically everyone on the registry. The frequency of reexamination will need to be determined from experience. Such a plan is economically and physically possible.

It is reasonable to assume that in Iowa, where in 1954 the rate for new active cases of tuberculosis was 16 per 100,000 population, eradication of tuberculosis can be accomplished by frequent reexamination of every tuberculin reactor.

—PAUL C. WILLIAMSON, *executive director, Iowa Tuberculosis and Health Association, Des Moines.*

## Developing a Tuberculin Testing Program in Iowa

Jones County, Iowa, in 1954 conducted a mass tuberculin testing program as a pilot study to determine the infection rate among the general population. The Epidemiologic Study Committee of the Iowa Tuberculosis and Health Association, which initiated the project, wanted to gather statistical data according to age, race,

sex, marital status, occupation, and information according to geographic areas such as urban and rural. In addition, the committee was interested in studying the cost of mass tuberculin testing and its effectiveness as a case-finding device in comparison with miniature film screening programs.

The decision of the county medical society to use the Vollmer patch test was based on the belief that it would be more acceptable to the public, that it would be more economical, and that the testing could be accomplished with limited personnel. At the same time, despite the limitations of the patch test, it was believed the survey would determine the infection rate trend in the community, and, in all likelihood, the patch test would not miss a case of tuberculosis in those tested.

A total of 12,392 persons were tested, or 63.8 percent of the 19,401 residents listed in the 1950 census. Of the population above 5 years of age, 69.1 percent were tested. There were 1,266 tuberculin reactors, amounting to 10.2 percent of those tested.

For both sexes, the highest percentage of reactors occurred in the age group 60-64 years. In men, the peak of 30.1 percent reactors occurred in the age group 55-59 years. In women, the highest percentage of reactors reached 22.1 in the age group 60-64 years. The mean age for all reactors was 42.1 years. The mean age for male reactors was 41.6 years and for female, 42.8 years.

The county was organized similar to the pattern used in fast-tempo miniature film screening programs. A receipt-book type of preregistration slip with carbon copies made it possible to keep track of everyone tested. The remaining slips revealed the name, address, and telephone number of those to be tested. Mobile X-ray units were used as interpretation centers. Each reactor was X-rayed at the time of the interpretation.

A registration card was devised to provide statistical information by machine tabulation. The cards were punched and tabulated according to age, race, sex, marital status, occupation, school, institution, and geographic area.



Cancer etiology rates in Cleveland study

Population	Number of persons	Cancer	
		Number	Per cent
Study group-----	666	20	3.0
Number with followup information <sup>1</sup> -----	593	20	3.4
Excluding definite and probable calcification-----	412	20	4.8
Excluding men under 45 and all women-----	225	16	7.1
Excluding definite and probable calcification, men under 45, and all women-----	161	16	9.9

<sup>1</sup> Does not include 51 persons known to be alive but for whom there is no other information, and 22 not known to be dead or alive.

no case of malignancy was the nodule smaller than 2.0 cm. The nodule was on the right side of the lung in 68 percent of the cancer cases and 61 percent of all study cases. A larger proportion of the medially located nodules were malignant than those in the lateral portion of the parenchyma.

Five hundred thirty-five of the patients (80.3 percent) never had any illness attributable to the nodule. After 5 years only 18 (2.7 percent) had died of the nodule, and only 23 (3.5 percent) of the living had any symptoms attributable to the nodule—17 had tuberculosis, 2 had cancer, and 4 had diagnoses of possible cyst, pneumonia, benign tumor, and suspected tuberculosis. In 90 (13.5 percent) the health status was not determined. Forty-four whose health status with respect to the nodule was not known died of unrelated causes. Twenty-four were known to be alive, but for 22 there is no information at all.

Age-specific mortality rates for the study population and for Cleveland are substantially the same. Although the total mortality among the study group was substantially higher than for Cleveland, the difference is attributed to the higher average age of the study group.

From these findings, it appears that a high index of suspicion of malignancy is warranted in white men over 45 years of age with nodules

of 2.0 cm. or larger. Individualized determination and utilization of every diagnostic tool are essential with the realization, however, that solitary pulmonary nodules are not as hazardous as previously thought. Unfortunately, it is not possible to prove preoperatively in the vast majority of cases which nodules are malignant and which are not.

### Recent Tuberculin Testing Experiences in Iowa

Our purpose is to find tuberculosis, and it stands to reason that we should search for it where it is most likely to be found.

With our long years of experience, it would seem that our approach in the future must give greater attention to those persons who are harboring tubercle bacilli in their bodies by evidence of their reaction to the tuberculin test.

Since 1952, an epidemiological study committee of the Iowa Trudeau Society has been investigating the extent of tuberculosis in Iowa. Among other things, the committee was curious to know the infection rate among the general population.

Investigation revealed that some tuberculin testing has been done in various locations in the State, but the programs varied widely from the standpoint of selectivity and techniques, and little emphasis was placed upon the accumulation of data. Thus, attempts to gather information on tuberculin testing were soon abandoned.

The committee felt that uniformity of procedures in tuberculin testing would have to be established in order to evaluate the amount of tuberculosis infection and agreed upon two approaches: school certification and mass tuberculin testing on a countywide basis.

The Iowa Subcommittee on Tuberculosis of the American School Health Association was appointed in December 1954. The subcommittee established standards to be observed in tuberculin testing of school students and school personnel in Iowa. Schools which meet the established qualifications receive the association's tuberculosis control award.



was 4 times greater than in the same period in 1954. On the other hand, 141 cases occurred in the nontuberculous pulmonary patients. Here, incidence in cases in the last 3 months of 1955 was 8 times greater than in 1954.

One hundred twenty-five cases of persistent infection occurred in the tuberculous group, and 60 cases in the nontuberculous group. In the former, incidence in cases in the last 3 months of 1955 was 26 times greater than in 1954.

To summarize, of the 298 primary cultures for atypical chromogenic acid-fast bacilli recovered from both groups of patients:

- 45 percent were from patients having treated active pulmonary tuberculosis.
- 3 percent were from patients having untreated active tuberculosis.
- 4 percent were from patients having inactive tuberculosis (both treated and untreated).
- 3 percent were from patients having treated nontuberculous pulmonary disease.
- 45 percent were from patients having untreated nontuberculous pulmonary disease.
- 44 percent were known to have had, at one time or another, cultures positive for *M. tuberculosis*.

Alarming increases in incidence of new and persistent chromogenic infections are occurring in tuberculous patients and in patients with nontuberculous pulmonary disease. Since our knowledge of the genesis of these organisms and their pathogenicity for man is incomplete, the prevailing situation should be of great concern.

—MARIE L. KOCH, PH.D., bacteriologist in charge, Clinical Laboratory, Wood Veterans Administration Hospital, Wood, Wis.

## Correlation With Socioeconomic Conditions in New York City

Since the beginning of the antituberculosis campaign in the United States, health authorities have paid special attention to the specific and nonspecific factors that influence the course of tuberculosis. The present investigation of socioeconomic conditions and known tubercu-

losis prevalence in New York City demonstrates one approach to some of the existing community problems in tuberculosis control. The full paper describes and supports with statistical evidence the association of known tuberculosis prevalence with unsatisfactory housing and inadequate income. It was published July 1956 by the New York Tuberculosis Association under the title "Socio-Economic Conditions and Tuberculosis Prevalence in New York City."

During the 3-year period 1949-51, the tuberculosis prevalence rate for New York City, which includes 5 boroughs, averaged annually 369 per 100,000 population. In Manhattan the rate was 665, or 80 percent higher than the overall average, and in Queens the rate was 32 percent lower, or 252.

At the same time, according to data available from the last decennial Federal census, the median family income during the year 1949 was \$3,526 for the entire city and \$3,073, or \$453 less, in Manhattan, but nearly \$600 more, namely, \$4,121, in Queens. In other words, the highest tuberculosis prevalence rate occurred where income was lowest, and the lowest tuberculosis rate was found where income was highest.

The proportion of dwelling units found to be dilapidated or with inadequate plumbing was reported in 1950. As against an average of 9.6 percent of such units for the city as a whole, 18.5 percent of the dwellings in Manhattan were comparatively unfit. But in Queens, the borough with a lower tuberculosis prevalence rate and a higher income, only 4.7 percent of the units were considered to be dilapidated.

It is worth noting that in Manhattan, with the highest tuberculosis rates, 80 percent of the health areas had an average of 200 or more residents per acre. In Queens, 90 percent of the area had fewer than 100 persons per acre. (Health areas are population units, made up of contiguous census tracts, used for vital statistics purposes in New York City. They average about 25,000 persons.)

True, home conditions are a reflection of economic ability to enjoy them. However, the communicable nature of tuberculosis demands

One section of the full report deals with medical management of suspects following X-ray examination of the reactors. In addition, the follow-through accomplished by the public health nurse is outlined, and a cost analysis is included.

—PAUL C. WILLIAMSON, *executive director, Iowa Tuberculosis and Health Association, Des Moines.*

### Treatment of the Nonhospitalized Patient— Advantages and Special Problems

Among tuberculous patients under supervision of the chest clinic of Bellevue Hospital, New York City, 510 have received antituberculosis drugs during the 2½ years since 1953. Nearly half began treatment on the wards of the hospital and were transferred to their homes to complete therapy, which has been continuous and consistent. Other patients were accepted from other institutions or started treatment as clinic patients. Results in this group are less gratifying.

Indications for therapy have been varied. The hospital inpatient service has been utilized when needed for special studies, ancillary services, or for surgical treatment. In this respect, the hospital clinic is well suited to conduct home treatment since hospitalization does not interrupt continuity of supervision. Clinical results have, in general, been consistent with expectations, and it is concluded that adequate treatment can be provided to outpatients when all clinical requirements are met without compromise. Certain groups of patients present special problems which are not easily solved in the clinic. Adolescents and elderly patients fall into this category, as do the occasional uncooperative, recalcitrant patients who are a problem wherever treated.

Best results are obtained when home treatment is begun after careful exploration of personal and social problems, and to this end social services are essential. Provision of diversional activity, rehabilitation services, and education regarding tuberculosis continues to be important but is more difficult for patients scattered

throughout the community than when together under one roof.

Individuals in home contact with patients have been examined and followed. Results are encouraging and suggest that risk is slight when therapy and supervision are adequate.

—FRANCES S. LANSDOWN, M.D., *assistant visiting physician*, JULIA M. JONES, M.D., *visiting physician*, ELEANOR MARTIN, M.D., *clinical assistant visiting physician*, and JEAN F. HUDDLESTON, M.D., *associate visiting physician, all with Bellevue Hospital Chest Service, New York, N.Y.*

### Emergence and Distribution of Chromogenic Acid-Fast Bacilli

The full report emphasizes changes in incidence or primary isolations of atypical chromogenic acid-fast bacilli (or new cases of chromogenic infection) and changes in incidence of persistence (or multiple cultures from single individuals) occurring in tuberculous patients and nontuberculous pulmonary patients at the Veterans Administration Center, Wood, Wis.

The period of observation extended from October 1954 through December 1955. For analytical purposes it is divided into 5 successive periods of 3 months each. Two hundred ninety-seven primary cultures were recovered from 6,116 clinical specimens cultured for *Mycobacterium tuberculosis*, an incidence of 4.8 percent.

Results show that, in both groups, changes in incidence of primary isolations undergo seasonal variations which reach their maximum in late fall and early winter, with lesser fluctuations in late spring and early summer. Concomitant cyclic changes also occur in regard to persistence, but only among tuberculosis patients. This phenomenon did not make its appearance in the nontuberculous pulmonary group until the seventh month of the observation period.

One hundred fifty-six cases of chromogenic infection occurred in the tuberculosis patients. Incidence in cases in the last 3 months of 1955

ing to uniform standards. We use an intradermal dose of 0.0002 mg. of a commercial purified protein derivative. The size of the induration is measured and recorded. An induration of 6 mm. or over is considered positive, but all indurations of less than 6 mm. are also recorded.

Each child in the schools is to be tested each year regardless of whether he had a positive or negative reaction the previous year, but special consideration is given to any child who previously experienced a violent reaction. Accurate records provide a detailed analysis and evaluation of the project as it progresses. Data from the records will be tabulated from machine punchcards. An attempt will be made to observe periodically until he leaves school each child who reacts positively. A file of individuals tested will be maintained, and new cases of tuberculosis reported in the future will be checked against this file.

The project nurses, with some assistance from the bureau of public health nursing, make a thorough investigation for the possible source of the infection in the environment of each child having a positive reaction. Tuberculin tests and X-rays of the people with whom he might have had contact are obtained through either the family physician or the Honolulu chest clinic. The name of the private physician is given on the consent slip signed by a parent of each child tested, and the result of the test, if positive, together with an explanatory letter, is sent to that physician.

The tuberculosis register and the records of the bureau of public health nursing and of the chest clinic are checked for all students who show a positive reaction so as to avoid duplication of effort and to obtain some evaluation of the tuberculosis control procedures already in effect.

The main objective of the project, therefore, is to determine how best to use the tuberculin test in the present control program. We wish to determine the case-finding potentials of the immediate examination of the positive reactors and to search for the source of their infection. We are curious about the feasibility of following up these positive reactors and of maintain-

ing a permanent current record of persons tested against which to check new cases as they are reported in the future. Such a study, properly administered over a period of years, should yield valuable information about the epidemiology of the disease and the significance of infection as well as information about the techniques and logistics of tuberculin testing which could be useful in future control plans.

Some of the data from the project are available in the full paper. About 97 percent of the student population in the project area are being tested. Elementary schools (kindergarten through 6th grade) have a prevalence of 3.6 percent positive reactors; intermediate schools (7th through 9th grade), 8.3 percent; and the high school students (10th through 12th grade), 19.4 percent. Although previously undiagnosed cases are being found, the results so far indicate that tuberculin testing as a case-finding procedure is considerably more expensive per case discovered than the present methods of mass X-ray surveys.

—ROBERT H. MARKS, M.D., *chief, bureau of tuberculosis, Territory of Hawaii Department of Health, and* HOLLAND HUDSON, *executive secretary, Tuberculosis Association of the Territory of Hawaii, both of Honolulu.*

### Effect of Chemotherapy on Long-Term Prognosis

During 1930-40 the death rate from primary tuberculosis on the children's tuberculosis service of Bellevue Hospital, New York City, was over 20 percent. Ninety-five percent of the deaths were due to meningitis and miliary tuberculosis, more protracted forms of hematogenous tuberculosis, and local progression of primary tuberculosis with cavitation and bronchogenic spread. With the advent of streptomycin, the death rate fell to 5 percent and more recently to 1 percent. The ultimate prognosis of the survivors can only be determined by long-term followup.

This has been achieved in over 98 percent of cases treated with specific therapy. Reported

that contacts with the disease in or outside the home must be under such conditions as to limit its spread.

Unemployment, and consequent limitation of income, brings with it a weighted chain of reduced income, poorer home conditions, and higher tuberculosis rates. In 1950, in the civilian adult population in New York City, slightly less than 7 percent were unemployed (6.9 percent). In Manhattan, where higher rents are demanded, unemployment was 8.4 percent. Again in Queens, with low tuberculosis rates, unemployment was but half (4.3 percent) that of Manhattan.

In like manner, data on the association of the above-mentioned socioeconomic indexes and tuberculosis rates have been compiled for all 5 boroughs of New York City, for the 30 health center districts in these boroughs and their subdivisions, the 348 health areas.

From these correlations in a great population center, it appears that tuberculosis prevalence is closely associated with housing and income.

The supporting evidence leads to the conclusion that, where urban living is accompanied by inadequate or slum housing, low income, and the deleterious effects of overcrowding and poverty, tuberculosis continues to exist at a higher level of prevalence than where the general physical and social environment is salubrious.

—ANTHONY M. LOWELL, M.P.H., *director, statistical division, New York Tuberculosis and Health Association, New York, N. Y.*

### Tuberculin Testing of Honolulu Children

In October 1955 a tuberculin testing project was launched in 26 Honolulu schools. Some 24,000 school children, from kindergarten through high school, will be tested each year for a period of 5 years. The area of the study includes the highest tuberculosis mortality and morbidity rates in the city. Six persons—3 public health nurses plus a practical nurse, a records analyst, and a clerk—are employed full time for the project by the Oahu Tuberculosis and Health Association. Medical direction is

by the chief of the bureau of tuberculosis of the Territory of Hawaii.

In 1930 a tuberculin testing survey in an intermediate school in Honolulu showed a prevalence of positive reactors of over 75 percent. By 1946 the prevalence had declined to 18 percent and by 1955 to 6 percent. These falling rates are part of the background facts which encouraged the long-range study.

Also, the tuberculosis control program in the Territory had received unusually good public support for many years. The relative proportion of beds available for the care of tuberculous patients has always exceeded that of most communities. Intensive case finding through chest X-ray surveys has been in progress since 1942. For a long time approximately one-half of the new admissions to the sanatoriums have been discovered in this way.

In addition, only 6 percent of persons who died of tuberculosis in 1955 were unknown to the health department before their death. The tuberculosis death rate of 55 per 100,000 population a dozen years ago was exceeded by only a few States. Now, the death rate of 6.4 per 100,000 is one of the lowest among the States. Since 1950, the rate has declined 71.1 percent although the number of new cases has declined only 23.4 percent. But the low yield of new cases discovered in the mobile X-ray unit surveys in some areas resulted in a search for more selective surveys and for other supplements to present case-finding efforts.

Some further reasons for studying a different approach to case finding included the occasional discovery of advanced tuberculosis in persons never previously X-rayed, the indifference of some of the population toward X-ray surveys, and the prevailing propaganda that tuberculosis is about finished as a public health problem.

Approximately a year of thoughtful discussion and planning among interested individuals preceded the project. Complete understanding and cooperation were obtained from tuberculosis and health personnel and from representatives of the schools and the medical society.

The technique of administering and interpreting the test has been carefully planned accord-

had had clinical tuberculosis or had died of the disease.

In the period of observation, 1943-53, during which 186,000 person-years were accumulated by the study population, 96 of the girls died, a rate of 50 for 100,000 person-years, when a rate twice as high was expected. Death rates for the group were much lower during the period of training and the early postgraduate years than were corresponding rates for women of the same age in the general population. Rates increased during the period of observation, and, by the end of the period, deaths from all causes equaled or perhaps even exceeded those in the general population.

The findings for two particular causes of death are of particular interest: The number of deaths from tuberculosis was only one-ninth of the number expected, and deaths from violent causes in the later years of the observation period accounted for two-fifths of all deaths. Motor vehicle accidents alone accounted for 14 of the 35 deaths from violent causes. Overdosage of barbiturates, suicides, and carbon monoxide poisonings accounted for 15 more. If the fatal barbiturate and carbon monoxide poisonings were in fact intentional, suicide would then be the most prominent single cause of death in the study population.

Although nurses undoubtedly are more highly exposed to communicable diseases than the general population, only a relatively small number of deaths were caused by such diseases. Instead, the greatest mortality risks of today's young nurses appear to be from causes not directly related to their professional services.

—ANDREW THEODORE, M.A., ANNE G. BERGER, B.A., and CARROLL E. PALMER, M.D., PH.D.,  
*Tuberculosis Program, Division of Special Health Services, Public Health Service, Washington, D.C.*

## **The Patient's Reaction to Hospital Treatment**

This study explored the range and diversity of attitudes toward hospital treatment held by 570 male tuberculosis patients in the Veterans

Administration Hospital, Madison, Wis. How do patients, in this age of chemotherapy and surgical procedures, feel about undergoing pulmonary surgery? What degree of faith do they have in the antibiotics they are receiving? How do they react to prolonged bedrest in the light of these new treatment methods? What are their feelings toward the medical personnel who are entrusted with their care?

Each patient filled out the Madison Sentence Completion Form, an attitude form designed specifically to evaluate the thoughts and feelings of hospitalized tuberculosis patients. In completing the 80 sentences of the form, the patient has an opportunity to express his reactions to bed rest, surgery, and other pertinent aspects of his treatment program. Analysis of responses revealed the following:

There does not appear to be a uniform set of attitudes held by all tuberculous patients. Individual differences in personal reactions and intensity of feelings are striking.

Bed rest tends to place an emotional strain on the majority of patients. Restlessness, depression, nervousness, boredom, and feelings of helplessness are frequent complaints. On the other hand, many patients are able to adjust adequately to long-term bed rest. A minority of bed resters express the feeling that they "never had it so good."

Many patients have marked difficulty in accepting their enforced dependency on the hospital staff. The majority, however, regard their dependency state as necessary for cure and appreciate the help given them.

Most patients indicate confidence in the effectiveness of the antimicrobial drugs and state they have benefited noticeably. Complaints about the disagreeable taste of para-aminosalicylic acid and the discomforting side effects of other drugs are not uncommon.

About half of the patients are willing to undergo pulmonary surgery if it is prescribed. Surgery is generally viewed as a means of speeding up recovery. Strong fears in regard to the operation often attend the acceptance or rejection of surgery. Many patients are either unwilling to reach a decision or indicate that they will turn down surgery.

in the full paper is the present status of survivors in the groups mentioned above who have been followed for more than a year.

—EDITH M. LINCOLN, M.D., *visiting physician, children's medical service, Bellevue Hospital, New York, N. Y.*, and PAMELA A. DAVIES, M.B., *and* GEORGE I. LYTHCOTT, M.D., *both instructors in pediatrics, New York University.*

### **Candida albicans: A Means of Detecting Tubercle Bacilli on Culture Media**

In 1954 I reported that a strain of *Candida albicans* which had been isolated from the sputum of a patient known to have pulmonary moniliasis and which failed to grow on Loewenstein's medium had produced a heavy growth of large creamy colonies on this medium when micro-organisms of *Mycobacterium tuberculosis* were present. In that story attention was directed to the fact that colonies of *C. albicans* develop at the sites on Loewenstein's medium in which there are tubercle bacilli.

This observation has been used to detect the early and as yet macroscopically invisible growth of *M. tuberculosis* on Loewenstein's medium inoculated with portions of specimens suspected to contain the micro-organism.

At the Royal Edward Laurentian Hospital, Montreal, during the past year, more than 1,000 specimens have been examined for *M. tuberculosis* by means of duplicate cultures on Loewenstein's medium. One tube in each set of duplicates was superinoculated with a suspension of *C. albicans* cells on the fifth day following inoculation with the material in which *M. tuberculosis* was being sought.

Examination of the superinoculated duplicates disclosed a heavy growth of *C. albicans* in certain tubes within a few days. Acid-fast bacilli were found among the yeast cells in every instance in which a heavy growth of *C. albicans* developed. The average time between the original inoculation and detection of acid-fast bacilli was 15.6 days. Examination of the control duplicates, on the other hand, only dis-

closed macroscopic evidence of growth of *M. tuberculosis* in 4 to 5 weeks.

The superinoculated duplicates also yielded evidence of *M. tuberculosis* half again as many times as the control duplicates. Up to the present time, most of the cultures of acid-fast bacilli that have been detected by means of, and isolated from, *C. albicans* have produced progressive tuberculosis in guinea pigs. However, 14 strains have been found of atypical chromogenic acid-fast bacilli which upon injection cause guinea pigs to become tuberculin reactors but seemingly do not incite progressive disease.

The fact that the superinoculation method yielded a greater number of positive cultures than the routine method indicates that *C. albicans* contains, or produces, a factor which stimulates the growth of *M. tuberculosis*.

A study of the clinical histories of the patients from whose specimens *M. tuberculosis* was isolated by the superinoculation method and not by the routine method disclosed that some of these persons had a positive sputum only on one or two previous occasions and that many either had been given, or were actually taking streptomycin, isoniazid, or para-aminosalicylic acid.

Preliminary in vitro experiments which have been carried out since the described study indicate that *C. albicans* promotes the growth of very small numbers of tubercle bacilli and that tubercle bacilli which have been exposed to streptomycin or isoniazid either fail to multiply or multiply only at a slow rate on standard culture media.

—EDITH MANKIEWICZ, M.D., *bacteriologist, Royal Edward Laurentian Hospital, Montreal, Canada.*

### **Mortality Among Former Student Nurses During the Last Decade**

Nearly 26,000 former student nurses first placed under observation while in training during 1943-49 participated in a followup study in 1952. The purpose was to determine how many

# Health Services for Children of School Age

**I**n school health services, as in the infant and preschool area, the Working Group on Service Programs recognizes wide variations in program content, stages of development, and available facilities in agencies providing school health services.

The Working Group on Service Programs recognizes also that changing concepts and new approaches are vital to the attainment of goals in health programs for school-age children. In view of the fluid state of school health services, it was considered neither desirable nor possible to prescribe specific statistical patterns applicable to all school health programs. Consequently, the proposals of the working group should be regarded as a framework within

which each school health agency may develop a statistical program in accordance with its own needs.

## PREREQUISITES

The following conditions must exist if meaningful service statistics are to be developed for a program of health services for school-age children.

1. The objectives and scope of the program must be clearly defined.

2. Education personnel and health program personnel, such as physicians, nurses, nutritionists, social workers, health educators, and statisticians, should have a part in determining the

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## Service Statistics

The Working Group on Service Programs of the Public Health Conference on Records and Statistics is issuing a series of documents on the collection and analysis of statistics recommended for various health department service programs. As these recommendations are completed and approved by the working group and the conference, they will be published.

An introduction to the series and the basic principles governing service statistics appeared in June 1956, page 519. These were followed in the July issue, page 705, by a statement on service statistics for the health supervision of infants and preschool children.

In developing this statement, the third in the series, the Working Group on Service Programs had the assistance of Dr. Alfred Yankauer, director, maternal and child health services of the New York State Department of Health, as medical consultant.

This report was approved by the conference membership in May 1954. It has been reproduced in mimeographed form as attachment A to document

312 by the National Office of Vital Statistics, Public Health Service, Department of Health, Education, and Welfare, Washington, D. C. Under the title "Guide to the Collection, Analysis, and Interpretation of Service Statistics in Health Services for Children of School Age," it has been endorsed by the Association of State and Territorial Directors of Local Health Services, the Council of State Directors of Public Health Nursing, and the Statistics Section and the Committee on Administrative Practice of the American Public Health Association.

Concurrently, with the development of this statement, the Committee on School Health Service Statistics of the School Health Section of the American Public Health Association was also addressing its attention to fallacies in the way school health statistics are often kept. The report of this committee was published in the *American Journal of Public Health*, May 1956, page 636. Interlocking membership of the two groups was arranged in order to assure basic consistency in the respective statements.

Most patients do not appear upset when hospital personnel and visitors wear masks. Instead, they recognize and appreciate the mask's value as a protective measure. A minority react negatively to the wearing of masks, feeling that it enhances the stigma of the disease.

Patients invariably prefer a physician who is professionally skillful, who explains their medical condition to them in a frank, compre-

hensive, and understandable fashion. On the other hand, most patients prefer nurses for their friendly, personal qualities rather than for their professional competence.

Despite the many frustrations of hospitalization, most patients feel optimistic about the future.

—GEORGE CALDEN, PH.D., *chief psychologist,  
Veterans Administration Hospital, Madison, Wis.*

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## *An Important Date*



Each month your health department and many hospitals, laboratories, schools, clinics, and homes receive a copy of PUBLIC HEALTH REPORTS, mailed to arrive on the 20th, or even earlier, depending upon geographic location of the subscriber.

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### *Scheduled for early publication*

Eastern States Health Education Conference  
Public Health Begins in the Family  
Nerve Gas in Public Water  
Progress in Leprosy Research  
Recent Surface Disinfection Studies  
Group Therapy Behind Locked Doors



## STATISTICAL INFORMATION

To determine whether the school health service is meeting its objective, extensive statistical data are needed for planning, administering, and evaluating the operation of the program. The following types of information are suggested for these purposes.

### For Planning a Program

Baseline data against which to measure progress in provision of health services are essential. The data suggested below for planning a program should be subdivided, if applicable, according to type of school (public, parochial, or private) which the children attend; or whether they are in hospitals or similar institutions; or whether for some other reasons they are not in school. The data should also be subdivided by agency administering the program and by type of service provided.

1. Population of school-age children by age or grade (or by ungraded classes), sex, and color (where significant).

2. Number of children in entering school population, by grade (or by ungraded classes).

3. Estimates of the future school population.

4. Socioeconomic characteristics of the population by geographic area as indicated by pertinent census data and by intercensal data such as general opinions of school principals, teachers, and nurses; special studies; welfare data; and other health department data.

5. Legal and administrative requirements affecting the school health program.

6. Morbidity and mortality data, by age and cause.

7. Information identifying existing health and medical facilities and personnel and other health resources in the school system and in the community, which would be available through the health department, board of education, other public agencies, voluntary health agencies, and private medical practitioners.

### For Administering a Program

The customary daily report of physicians and nurses, which shows the number of examinations given, conditions found, and corrections made, tells little about what has been accomplished and what needs to be done in any classroom. Not all conditions can be corrected, and

not all corrections relate to conditions found upon original examination. The best the health service can do is to get the children under medical supervision. The number of corrections recorded for a current year cannot be directly related to the number of conditions found because the former may be the outcome of an examination in a preceding term or year. A statistical report of corrections, unless related to group examined, fails to reveal the actual service received. For administrative purposes, however, a summary of current information, by geographic area when indicated, is needed.

For the reasons stated, information similar to the following frequently is required, in addition to the baseline data previously enumerated for planning a program.

1. Number of children referred through observation of teacher or nurse.

Practically every school child is observed to some degree for health status by the teacher or the nurse.

2. Number of children examined, with or without the parent being present, by the school physician, by a private physician, or by some other physician; and number examined by the school dentist, by a private dentist, or by some other dentist.

The following information should be organized by the type of agency (board of education, health department, or other) and by the type of physician or dentist providing the service.

Entering children: Number found with and number found without conditions needing attention.

Reexamination of selected grades: Number of children found with and number found without conditions needing attention.

Referral examination by source (specify) of referral: Number of children found with and number found without conditions needing attention.

3. Number of children screened and referred by nonmedical procedures.

Specify type of procedure: Number referred and number not referred for further examination.

4. Distribution of children examined, by health status (with or without health needs), color, sex, and age or grade:

Number of children examined or observed.

Number of children for whom further attention is indicated.

kinds of information needed and in developing plans for its collection. The statistician should function as a member of this professional team in initial planning of the program as well as in program operation and evaluation.

3. The information required should be clearly understood by, and should be acceptable to, medical and dental societies and other participating personnel and agencies.

4. The purpose to be served by the statistical data should be clearly specified. Reports should be prepared only to fulfill specific purposes.

5. Provision should be made in advance, during the initial planning stage, for periodic evaluation of statistical procedures.

6. Statistics developed for health services to school-age children should be correlated with statistics developed for related programs of the health department. One means toward this end is to have a records committee periodically pass on and review basic statistical forms of the several programs.

Other factors involved in effective evaluation which cannot be totaled and tabulated, such as local physicians' cooperation, availability of adequate facilities and qualified personnel, and attitudes and habits in relation to health, must be borne in mind.

## BASIC CONCEPT AND OBJECTIVES

It is generally accepted that a program of health services for school-age children should consist of three major segments: health instruction, maintenance of healthful environment, and health services. This report is confined to suggestions for the development of statistics related to health services. School health services may be provided by the health department, by the board of education, or, in some instances, by another agency.

The emphasis in school health programs has changed from merely finding and correcting physical defects to the health appraisal of children as individuals, the solution of their overall general physical and emotional problems, and the education of the child and family in healthful living.

It is agreed that health programs for children of school age should be sufficiently broad

in scope to include not only services for children in public, private, and parochial schools but also services for school-age children who, for health or other reasons, are not in any school. Information should be available on the services provided for each group.

It is recognized that data on the child not registered in school may be difficult to obtain, but, when such information is available, it is desirable to include it in administering a program. Possible sources are records from public health nursing offices, crippled children's services, and special clinics.

Because of the many variations in school health programs, no standard pattern of services prevails. However, it is possible to set forth basic objectives toward which all programs are directed to a greater or lesser degree. These objectives may be stated briefly as:

1. Finding children in need of medical or educational observation, counseling, and treatment by:

Observation by teacher or nurse.

Appraisal by physician and dentist either through school health services or through some other source.

Nonmedical screening (vision, hearing, dental inspection in school, height and weight measure, health inventory) and self-referral.

Absence from school or nonregistration.

2. Followup (and continuation of followup) of child in need of care to the point of definitive diagnosis or to the point of receiving care, and giving care where it is within the scope of the program. Examples are:

Observation by teacher or nurse.

Examination by school physician.

Counseling by nurse, physician, and others that child seek service or treatment.

Examination by specialist or consultant.

Provision of immunization.

Medical or dental treatment.

Provision of special education service.

Obtaining report of service provided.

Implementation of report, if further service is indicated.

3. Minimizing the hazards of school attendance by means of communicable disease control and accident prevention.

4. Provision of emergency service, such as care of injured or sick in school.

5. Health guidance and counseling through contacts with children, parents, teachers, and community agencies.

## For Evaluating a Program

The working group believes that analyses of results of medical examinations, case-finding services, and followup data would be more valuable than many unrelated statistics currently being accumulated. In addition, periodic analysis of the school health record of each child is desirable. It is not necessarily recommended that the entire program of school health services should be evaluated routinely. Detailed analyses are generally more useful when handled as a special study.

### *Medical Examination*

Studies of records of medical examinations can provide indexes of health needs. Analyses of physical defects by type and severity of condition can provide data useful both in indicating preventive measures and needs for services. In considering medical examinations as an index of health needs, it should be borne in mind that the diagnostic findings of the school physician's examination cannot always be definitive and that his examinations may not cover that portion of the school population examined by private physicians. Moreover, records and reports of the private physician may not be comparable with those of the school physician.

### *Case-Finding Services*

Information and data of the following type are useful for analyzing case-finding services:

What was the source of finding the case?

What was the type of condition found?

Was the needed service provided? (This is useful information both for evaluating the program and for indicating gaps in community services.)

How many conditions found for the first time in reexamination might have been found earlier (either by a more careful referral program or at the time of a previous examination)?

How much over-referral and under-referral resulted from nonmedical screening or teacher observation?

### *Followup Data*

Information regarding followup activities and the results obtained from followup are probably the most revealing index to accomplishments of the school health program. The

final results of followup, or some record as to whether the condition is in need of followup, should always be clearly stated in the basic record. At the time of a reexamination, current findings should be reviewed to determine what services the child has received as a result of the findings in the previous examination.

Information on the health status of the child, based on his condition at an interval after the initial finding together with an accounting of what has been done in the interim, is valuable for program planning and operation. This type of reappraisal after reasonable followup provides a measure of evaluation of the services provided.

A periodic review of individual records, annually if possible, is a better source of material for evaluating services performed and the results obtained than the compilation of daily reports of physicians' and nurses' activities. Records of children needing further attention should be analyzed more frequently than records of other children.

### *School Health Record*

Inasmuch as the ultimate goal of a health program for school-age children is better service for the child, it is important to have a separate health record for each child. Because successful evaluation of the program is dependent on the extent to which necessary information is available, the school health record should be designed to provide information on the type of service provided and on the findings, and to give specific recommendations for further services based upon casefinding and followup, illness and accident data, and pertinent absentee data.

## TABULATION METHODS

The following methods are suggested for tabulating program statistics. They may be used in combination.

*Manual methods.* Abstracting information by manual sorting and counting individual case summary cards, or tally sheets, is applicable to small health departments, but these methods do not lend themselves easily to correlation of information.

*Marginal-punched, hand-sorted cards.* This

Number of children with conditions, single or multiple, needing attention.

Number of children not needing any further attention.

Number of children, and percentage of total children examined or observed, in specified diagnostic groups.

5. Distribution of children with and without health needs by method of finding.

Breakdown according to:

Medical examinations (whether new admission, re-examination, that is, periodic additional examination, or whether referral by teacher, nurse, or parent).

Screening.

Teacher observation.

6. Types of conditions most frequently needing attention, such as nutritional, vision, cardiac, skin, ear, and orthopedic conditions, or behavior problems.

These might be listed according to:

Static handicap (such as club foot) which should be noted.

Handicap which needs attention but which is not receiving it.

Handicap which is receiving attention but which should be followed to see that attention is continued.

7. Diagnoses showing statistically significant differences observed in color, age, and sex groups, or for other important variables; for example, economic status and geographic location.

8. Statistics relating to the volume of other services, such as immunizations, dental services, first aid.

These data need not be collected routinely but may be the basis for special study.

9. Statistics of services not rendered; for example, services which are planned but which are not possible to provide, and the reasons why.

10. Statistics of followup services for children found by the several casefinding methods.

These data have to be obtained on a longitudinal basis, that is, over a period of time.

11. Counts of some educational services, such as number of nurse conferences with school staff, teacher-nurse conferences, talks to community groups.

These items do not measure quality, but they do tell what is being done with respect to selected aspects of the program. It is not necessary, however, that complete information of this kind be kept constantly. The desired in-

formation may be obtained through special studies at selected time intervals.

12. Data on a number of special services that may or may not be administered by health or education departments.

These are the services provided for handicapped children of school age and the services provided by cardiac and tuberculosis clinics. Data on such services should be correlated with regular school health statistics.

13. Summary of results of previous findings.

As a supplement to the types of current reporting listed in paragraphs 1-12, a summary of the action taken is also suggested. For a particular group examined in the previous year, a summary record would reveal whether the children who needed attention received it during the 12-month period following the examination. Summarized information of this type gives a more satisfactory picture of the accomplishments of the program and what remains to be done than does a detailed count of conditions found and corrected within a current year.

14. Analyses of absences by type of illness and length of absence.

Absentee records are a potential source of useful data for indicating preventive measures and needs for services and for reflecting acute and chronic conditions. Absentee records would be analyzed only as a special study, especially when the absences are repeated or long-term absences occasioned by illness. It is important to know the reasons for absence, to know how many conditions received attention, what are the needs of children who did not receive care, how much absenteeism could have been prevented, and to what extent absenteeism might have been shortened.

15. Data on the types and results of accidents.

Inasmuch as accidents are the leading cause of death among children of school age, accident statistics, if they are to be complete, should contain information on the nature of the accident, part of body injured, how, when, and where the accident happened (supervised or unsupervised play), treatment given, followup needed, days absent, and whether a physician was required. Accident data are valuable for planning educational programs of accident prevention and correcting the conditions which lead to the occurrence of accidents.

*For health workers, students, and others unfamiliar with techniques of industrial hygiene, a definition of terms and an explanation of the procedures in the technology of air sampling are contained in this talk presented to the chemical section of the 43d National Safety Congress and Exposition, Chicago, October 18, 1955.*

## Some Basic Principles and Problems of Air Sampling in Industry

By CHARLES D. YAFFE, M.S.

INDUSTRIAL HYGIENE is concerned with everything in the working environment including, of course, the air surrounding the worker. That air, in addition to its normal constituents, may contain foreign substances or contaminants in solid or gaseous form. Unless it is prepared specially in the laboratory, air always contains some contaminants, so it is not strictly correct to say that air is "normal" only when it is "pure." One of the objectives of air sampling is to determine how much of a given contaminant is present in the working atmosphere.

### Types of Airborne Contaminants

Airborne contaminants may all be classified chemically. They may be further sorted into

two major groups, depending on whether or not they are living matter, such as bacteria, viruses, or molds.

In addition to finding impurities of a chemical nature in air, we also encounter various forms of energy such as light, sound, and radioactivity. These are also parts of the working environment that are of interest to the industrial hygienist. Again, as with airborne substances, these are normally present everywhere, and our interest is primarily with "how much." The measurement of these energy forms, which are sometimes referred to as physical agents, is a broad and complex subject outside the scope of this present discussion, which will be limited to the airborne contaminants referred to as chemical agents.

The methods employed in measuring the amount of a contaminant will depend on the form in which it exists in the air. The forms in which contaminants are found in the air may be classified as dusts, fumes, gases, vapors, and mists.

Dusts and fumes are solid particles which differ in their size and method of production. Dust is produced when solid material is broken up by such operations as crushing, grinding, drilling, and blasting. Fumes, on the other

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*Mr. Yaffe, chief, Program Services, Occupational Health Field Headquarters, Public Health Service, Cincinnati, is also one of the technical editors of the Encyclopedia of Instrumentation for Industrial Hygiene, published April 1956 by the University of Michigan in cooperation with the Public Health Service.*

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method permits ready analysis where the volume of service is not large enough to justify mechanical tabulation.

*Mechanical tabulation.* This method is practical in health departments with a large volume of services.

### POINTS FOR EMPHASIS

Advance planning for the collection of data is an important aspect in the accumulation of meaningful statistics. Program directors, nursing personnel, statistics staff, field personnel working with the records, school administrators, and teachers should be included in the planning. Within the program area there should be clear understanding of the definitions and need for uniformity in recording and reporting. Particularly is it important that local medical and dental societies have such understanding.

Final responsibility for decisions regarding terminology and classification would seem to rest with program directors working with the education and nursing personnel, statistics staff, and members of the field staff who use the records.

Statistical approaches to health needs of children of school age are complicated and should be undertaken as a well-defined study. For statistics to be meaningful, an adequate followup system should be provided, and a concise record should be maintained of the service rendered. In analyzing school health data, one area of information at a time should be mapped out for study. As the usefulness of the collected information is determined, specific items can be continued or dropped as indicated.

Compilation of all service statistics on a school-year basis is recommended for comparison with baseline data. Where these statistics are required for fiscal purposes, compilation on a fiscal-year basis should supplement, but not substitute for, school-year data. The working group cautions against more frequent tabulations than are justified by use.

With the trend toward having children examined by the family physician instead of by a

physician employed by the school or health department, the collection of statistics on conditions needing attention becomes even more difficult. Accurate sampling studies within a school health service are believed to be more fruitful than the year-by-year accumulation of meaningless numbers of different categories of conditions. Cooperation with local and State medical societies is important in making the special studies. Special studies done on a sampling basis, when indicated, are recommended as a device to reduce the number and complexity of routine reports wherever possible. Routine reports should concentrate on minimum essentials for reflecting program activities and should avoid over-refinement of data.

The working group believes that the frequency with which specific reports should be compiled must be determined locally, depending on uses to be made of the data. It recommends that unduplicated counts of school-age children served would be most meaningful when tabulated annually, on a school-year basis if possible.

Statistical measurements of service should be interpreted in relation to baseline data, need for services, and program objectives. Only thus can an approach be made to evaluating accomplishments of a program.

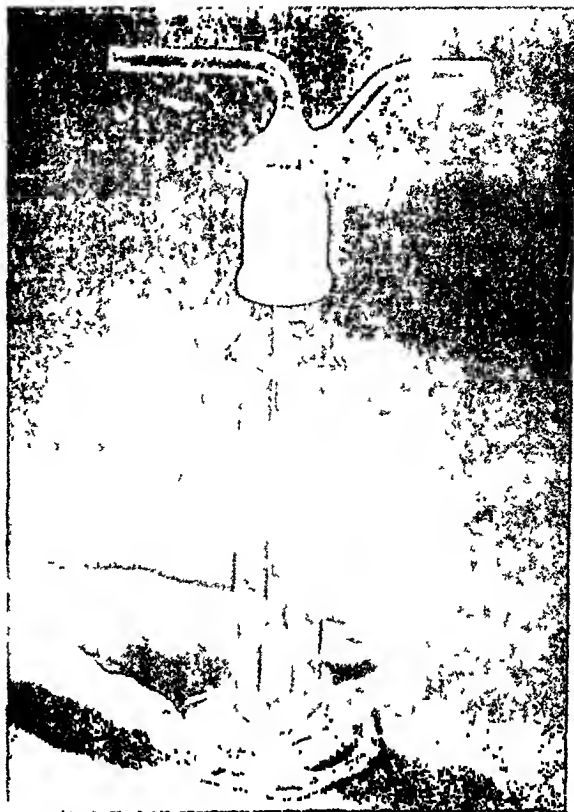
Traditionally, age breakdowns have been regarded as providing an essential basis for determination of health needs. The working group believes, however, that insofar as school health services are concerned a grade classification would be more practical administratively inasmuch as records are usually kept by grade and little is lost in the way of age classification. Some general information on range of ages by grades and by various types of schools should be available, however, so as to relate school health service statistics to other available statistics.

In formulating this statement, the working group has emphasized throughout the importance of data analysis as well as data collection. The group believes that, for maximum utilization of service statistics, further expansion of this phase of statistical study should be carried out through the team approach.

been and probably will continue to be difficult to answer for a long time to come.

It is not a simple matter to determine how toxic a substance is, particularly when the avenue of attack is through the lungs. This is true for several reasons. One is that the amount inhaled will vary according to how much physical effort is involved on the job. A man doing heavy work will require much more air than a man in a sedentary job, and he will, therefore, take in more of any contaminants in the air. Another problem, with dusts, is that the amount penetrating into the lungs depends on the size of the particles. Another complicating factor is the sometimes considerable variation in individual susceptibility. Two men may work side by side for many years in a dusty atmosphere. One may eventually die of silicosis while the other never develops any measurable disability attributable to the dust.

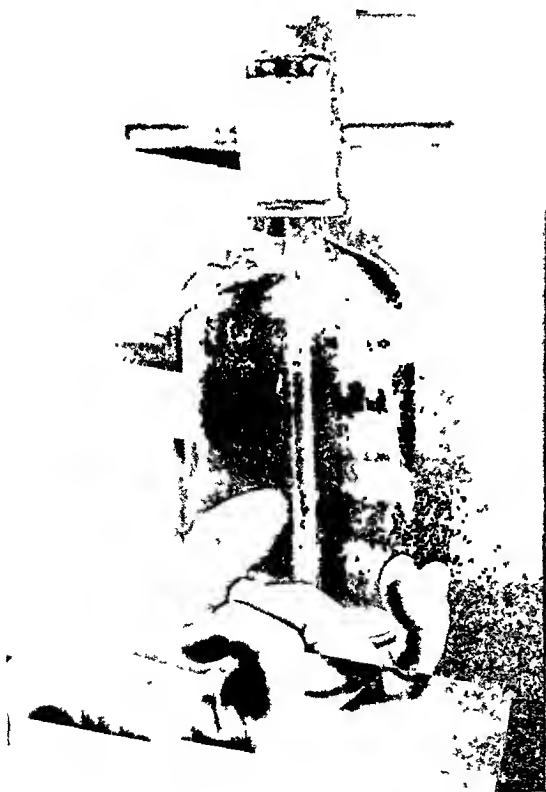
The range of variation is extended even further when we include the person who has an allergic response to even minute amounts of a substance. Another important complication



Fritted bubbler.

arises when a contaminant has more than one possible effect. For example, suppose it is found that a great number of people work with a given material without discomfort or evidence of injury provided the concentration of the substance in the workroom air is kept below a certain point. Let us assume, however, that an analysis of the death certificates of people who had worked with the material reveals that the cancer rate among the group is twice as high as for people who did not handle the material. The question then arises, "Did this material cause the increase in the cancer rate?" If, and this is sometimes a big "if," the relationship is clearly proved, the next and more difficult question is, "How much of this material is necessary to cause cancer and how long must the period of exposure be?" Fortunately, most materials do not present such complex problems.

We frequently do have the problem, however, of distinguishing between what is acceptable exposure for short periods of time and what is the maximum amount of the substance that can be safely tolerated 8 hours daily, 5 days a week,



Evacuated bottle for air sampling.



hand, are formed by the condensation of solid substances which had been vaporized by heat, such as would occur in welding or furnace operations of various types.

Dusts are generally larger in size than fumes although there are no definite size limitations for either. Large dust particles usually do not present serious hazards to health because, first, since they tend to settle to the ground quickly, they are less subject to inhalation, and, second, if they are taken in, they are usually trapped in the nose and seldom penetrate into the respiratory system to a point where they may remain long enough to cause injury.

Ordinarily, for health purposes we are interested in dust particles smaller than 10 microns in size. A micron is 1 millionth of a meter or approximately 1/25,000 of an inch. A 10-micron particle is about the smallest that can be seen with the naked eye. Most of the dust that is our concern has been found to be between about one-half micron and 3 microns in size although the electron microscope has shown the frequent presence in the air of many smaller dust particles. The electron microscope has also shown that more of this very fine material is retained in the lungs than was formerly believed.

The size range of dust particles produced by industrial operations will vary, depending on both the process and the material involved. The average or median size of industrial dust as determined with the ordinary optical microscope is usually fairly close to 1 or 2 microns.

Fume particles are generally smaller in average size than the dust particle; the maximum size is usually below one-half micron. Fume particles can join together, however, so that with time the average size may increase after formation.

Gases include those elements and compounds that are found only in gaseous form at ordinary temperatures and pressures. Oxygen, nitrogen, carbon monoxide, carbon dioxide, and chlorine are well-known examples.

Vapors are the gaseous forms of substances that also exist in liquid form at ordinary temperatures and pressures. Common materials of this type are water, gasoline, carbon tetrachloride, benzol, and mercury.

Mists are droplets of liquids, produced either

by atomizing, as in spray painting, or by condensation, as with water that becomes fog or steam. Because mists are particulate in nature, they may sometimes be collected with the same kind of instruments used for dusts or fumes.

My remarks here omit any discussion of the sampling of airborne micro-organisms, such as bacteria, except to mention that they are often of the same size range as dusts and fumes. Though sampling instruments for those particulates often are capable of collecting airborne micro-organisms, some of the instruments kill the organisms and are therefore considered undesirable in biological sampling studies.

### Appraisal of Health Hazards

Before discussing actual sampling methods, we might ask, "Why analyze the air?"

Air often is analyzed for purposes other than to determine health hazards. Industry frequently samples the air in certain locations to determine the presence of leaks which could represent a loss of valuable material or of a fire hazard, an explosion hazard, or a nuisance to the neighborhood. Smoke is measured to determine whether an operation is contributing to a community air pollution problem as well as to find out whether fuel is being utilized efficiently. Information obtained when sampling for one purpose can often be of considerable value for other purposes. For example, concentrations of poisonous materials that are low enough to be breathed safely for an 8-hour work period are without exception far below the lower explosive limit. In other words, if the health hazard is controlled, the explosion danger is eliminated too.

The sampling of air for so many purposes means that the associated problems have been approached independently by various groups, each having different aims, backgrounds, and viewpoints. The resulting interchange of ideas has been beneficial to all concerned. Principles developed for one objective have often turned out to be exactly what was needed to achieve other objectives.

Now, let us consider specifically some of the methods and problems connected with the appraisal of health hazards. The first question is, "How much is too much?" This has always



been and probably will continue to be difficult to answer for a long time to come.

It is not a simple matter to determine how toxic a substance is, particularly when the avenue of attack is through the lungs. This is true for several reasons. One is that the amount inhaled will vary according to how much physical effort is involved on the job. A man doing heavy work will require much more air than a man in a sedentary job, and he will, therefore, take in more of any contaminants in the air. Another problem, with dusts, is that the amount penetrating into the lungs depends on the size of the particles. Another complicating factor is the sometimes considerable variation in individual susceptibility. Two men may work side by side for many years in a dusty atmosphere. One may eventually die of silicosis while the other never develops any measurable disability attributable to the dust.

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Fritted bubbler.

arises when a contaminant has more than one possible effect. For example, suppose it is found that a great number of people work with a given material without discomfort or evidence of injury provided the concentration of the substance in the workroom air is kept below a certain point. Let us assume, however, that an analysis of the death certificates of people who had worked with the material reveals that the cancer rate among the group is twice as high as for people who did not handle the material. The question then arises, "Did this material cause the increase in the cancer rate?" If, and this is sometimes a big "if," the relationship is clearly proved, the next and more difficult question is, "How much of this material is necessary to cause cancer and how long must the period of exposure be?" Fortunately, most materials do not present such complex problems.

We frequently do have the problem, however, of distinguishing between what is acceptable exposure for short periods of time and what is the maximum amount of the substance that can be safely tolerated 8 hours daily, 5 days a week,



Evacuated bottle for air sampling.

and, where community air pollution is involved, 24 hours a day for an indefinite period.

### Negative and Positive Data

Toxic materials do not all act in the same fashion. Some may be stored in the body until a certain excess is accumulated, whereupon the individual suddenly develops symptoms of toxicity. Other materials may be eliminated without injury occurring unless the initial dose is large enough to cause immediate effects. Still others may cause definite harm directly in proportion to the amount absorbed. Recovery may or may not occur, depending on the nature of the damage inflicted.

Actually, despite the difficulties in working out recommended standards for substances, much useful information has been developed for a number of elements and compounds, and reasonably satisfactory benchmarks have been established for many others. Each year our knowledge becomes more precise. The infor-



Carbon monoxide sampler.



Midget impinger.

mation comes both from laboratory research on animals and from practical experience in the field where the safety factor is put to the test by people at work.

It is here that air sampling provides its maximum usefulness whether the environment is hazardous or not. It is as important to measure what is safe as to measure what is dangerous, for the objective is to provide healthful surroundings, and these must be defined. For this reason, negative data are at least as valuable as positive data.

Since different substances have different toxicities, the amounts that are dangerous will differ. The quantities involved where air sampling is concerned, however, usually have one thing in common: The actual amount collected and available for analysis is extremely small. More precise techniques than those ordinarily needed in analytical procedures, therefore, often have to be employed.

I am reminded at this point of 99.44 percent purity. Let us consider the 56 one-hundredths

1 percent of an airborne impurity such as, carbon monoxide. Concentrations of gaseous contaminants are usually expressed as parts per million. One percent equals 10,000 parts per million; therefore, 0.56 percent is equal to 560 p.p.m. A person breathing air containing that much carbon monoxide would die in less than an hour.

The maximum acceptable concentration for carbon monoxide for an 8-hour exposure is 100 p.p.m., or 1 one-hundredth of 1 percent. Thus, so far as carbon monoxide is concerned, the air must be at least 99.99 percent "pure."

While carbon monoxide is a dangerous adversary, which must be treated with great respect because it is odorless and colorless, there are other far more poisonous gases. The allowable limits for arsine, phosphine, and ozone, for example, are much less than 1 p.p.m.

### Size and Type of Sample

The amounts of some solid materials which must be measured as dust or fume are also exceedingly small. As an example, the recommended limit for 8 hours' exposure for cadmium is 0.1 milligram per cubic meter of air. Or, in units easier to visualize, the limit would be approximately 1 ounce in 10 million cubic feet of air. Fortunately, analytical techniques do not call for an ounce of material. Sampling equipment capable of handling 10 million cubic feet of air in a reasonable time interval might lack portability, to say the least. As a matter of fact, laboratory methods are so sensitive that we can readily determine whether the limit for cadmium is exceeded by analyzing the amount removed from 20 to 30 cubic feet of air. The same is true for most other particulates.

The amount of a contaminant in the workroom air may vary considerably during the course of operations. Consequently, we are often interested in extremes of exposure as well as in the average exposure since very high concentrations for a short time may sometimes cause trouble even though the average for the day is not excessive. Therefore, we need to collect two different classes of samples: one for long periods to measure the average exposure, the other for short periods to give information about the fluctuations in concentration.

The time required to obtain an accurate evaluation of the average exposure will, of course, depend on the length of the operating cycle, on variations in production rates, and so forth. The average concentration of vapor around a cleaning vat where parts, all of one type, are carried on a conveyor at a uniform rate might be determined satisfactorily from an hour or so of sampling whereas an operation of an intermittent nature and of varying workload might require a number of samples collected over a period of days or even weeks, and, in some cases, the collection of single samples for hours or even days.

The time interval employed in the individual samples collected for measuring fluctuations in concentration depends on needs and also on the instruments employed. Some devices used for such purposes collect what are variously called "instantaneous," "snap," or "grab" samples. With these the volume of air sampled is small, ranging usually from a few cubic centimeters to the amount held by a small bottle or flask. Ordinarily, a few seconds or less is sufficient time to collect grab samples. Where large volumes of air must be sampled to get enough material to analyze, equipment designed for long-period sampling may be employed for the shortest time interval practical in the circumstances.

Ideally, a sampling technique should give an immediate answer. A number of instruments and methods which do give desired information instantaneously or within a few minutes have been developed, and the prospects are bright for more equipment of this type. At present, however, measurement of most airborne contaminants requires the collection of samples which must be returned to the laboratory where hours or even days of processing are required to yield the answers.

### Types of Instruments

I will not attempt to describe in detail the many types of instruments used in air sampling. Generally, however, they have a source of suction to draw the air through some type of collecting or analyzing device and a means for measuring the volume of air sampled.

If a sample is to be collected continuously over a fairly long period to evaluate average con-



Gas sampling tube.

ditions, or if we wish to sample a relatively large volume of air, we would probably use a motor-driven pump. In atmospheres where the possibility of explosion must be considered, we would probably avoid using electrical equipment and use compressed air or hand-operated pumps instead. The sampling rates employed seldom exceed 2 or 3 cubic feet of air a minute and often are less than a tenth of such rates. Rotameters, pressure gauges, orifice meters, or other appropriate metering devices, may be used to measure the air flow.

The collecting mechanisms employed are numerous because of the variety of contaminants. Particulate material, such as dust, might be collected on one of the many filtering materials in common use or might be picked up by an electrostatic or thermal precipitating device. Another common technique employs impingement. The choice of collector would depend also on whether the dust is to be weighed, counted, measured for size, or subjected to chemical analysis.

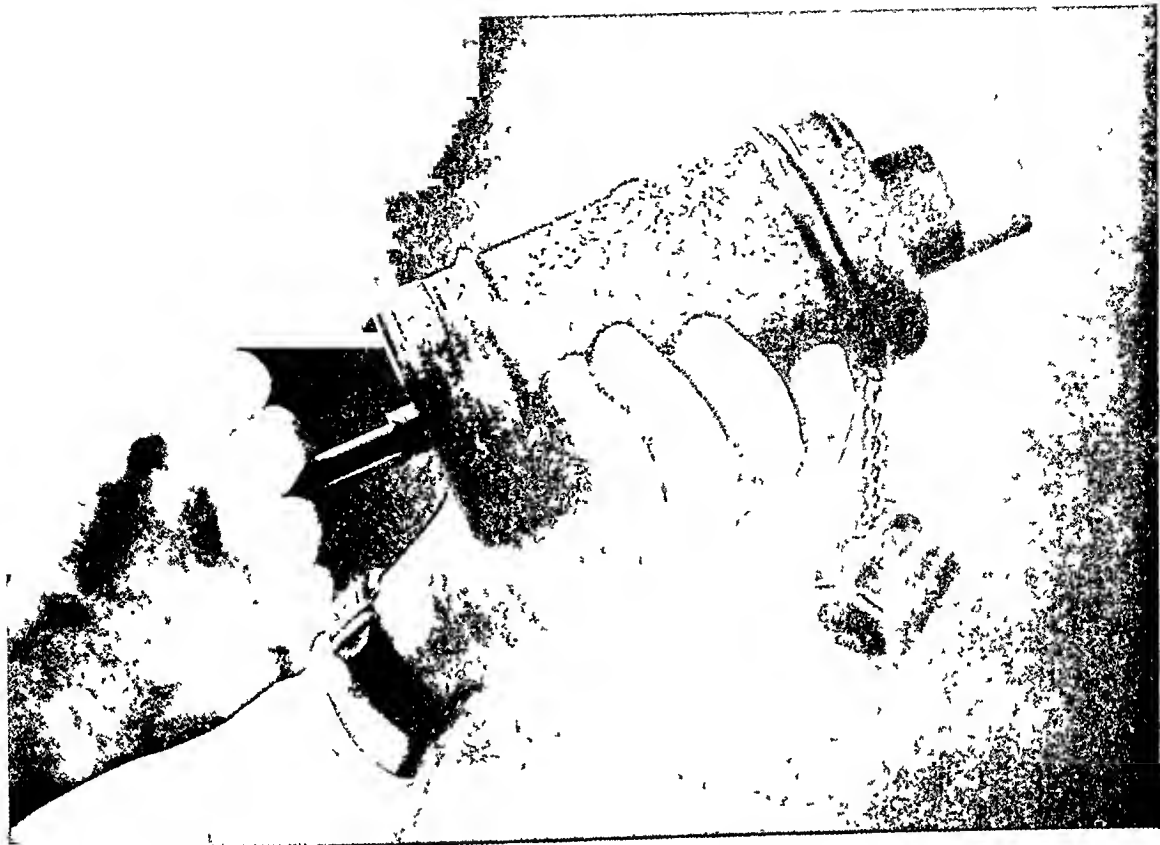
Gaseous matter might be absorbed by bub-

bling it through a suitable collecting liquid or by adsorbing it on such material as activated charcoal or silica gel.

Instantaneous or grab-type samples of gases might be collected in bottles or flasks which are first evacuated in the laboratory and then opened at the sampling point. Another technique is to displace the air in a double-inlet type of bottle, usually with a hand-operated pump or rubber aspirating bulb. A simple procedure is to fill the bottle with water; as the water drains out, it is replaced by the air to be sampled.

Sampling devices of various types are pictured in the accompanying photographs. They all have two features in common: small size and simplicity of operation.

As stated before, the preferred instrument is one which gives an on-the-spot answer. Among interesting instruments of this type are simple devices in which air is drawn by means of rubber aspirating bulbs through tubes of chemicals; the chemicals develop immediate color changes proportional to the amount of specific contaminants present. Tubes containing chemi-



**Hand-operated pump for filter sampler.**

cals are available for measuring carbon monoxide, hydrogen sulfide, hydrogen cyanide, and possibly other gases. Oxides of nitrogen may be measured in the field by collection in large hypodermic syringes and comparing with standards the color developed when suitable chemical reagents are added.

Other more complex devices for obtaining answers in the field utilize some physical characteristics of the contaminant in question. One group of instruments utilizes the principles of combustion. For example, vapors that are combustible may be burned on a heated platinum wire in a balanced electrical circuit. The vapors, in burning, raise the temperature of the wire, increasing its resistance, and the change is measured with a galvanometer. Since such instruments are not specific, it is necessary to calibrate the instrument for the particular contaminant.

Certain substances such as the vapors of mercury and of some chlorinated hydrocarbons will prevent the transmission of ultraviolet

light. This property is utilized in some instruments by measuring the amount of ultraviolet absorption. The measurement is indicated on a dial.

Some instruments indicate the number of dust particles in the air. These devices are usually based on a measurement of the amount of light scattered by the dust. Even though they have certain defects, they are useful in determinations of dust of uniform particle size.

Recording devices are being employed with increasing frequency to provide a permanent record of the air conditions measured continuously at a specific location. When attached to suitable instruments, recorders show the fluctuations in concentration which take place and, when compared with concurrent work records, often indicate where control measures or changes in operating methods are advisable. Recorders operate on various principles, for example, changes in electrical conductivity produced by absorption of such gases as sulfur dioxide.

## Maximum and Specific Limits

Before concluding, I should like to return to the subject of limits since air sampling to determine health hazards usually requires a decision by authorities that a hazard is or is not present, and, should it be present, they must also decide how serious it may be.

For many years there have been figures known as M.A.C. values with M.A.C. standing for "maximum allowable concentration." The expression has often been a center of controversy because of differing viewpoints concerning interpretation of the values. In jurisdictions where lists of M.A.C. values are part of legal regulations, some administrators have operated on the basis that any sample showing an M.A.C. to be exceeded is a violation. Similarly, I suppose, so long as the M.A.C. is not exceeded, the interpretation would be that no problem exists.

Actually, of course, the question is not so simple. As I stated earlier, although we now have fairly satisfactory toxicological information about a number of substances, the limits in common use do not necessarily represent similar degrees of hazard. Some limits are established to prevent serious injury or possible death. Others are to prevent concentrations that would be irritating to breathe, though not necessarily dangerous. Still others are to prevent levels of odor that are disagreeable. The degree to which people can tolerate or to which they are at all disturbed by such conditions varies greatly, and it is not possible to determine exactly how much of their disturbance is psychological rather than physiological, nor is it correct to dismiss the psychological condition or effect as unimportant.

Most people experienced in industrial hygiene are aware that M.A.C. values for different substances have different origins and represent different degrees of hazard. Because of this, there has been a search for many years for a better expression than "maximum allowable concentration." "Threshold limit value" is one such term. It implies something possibly less legalistic since more than one type of threshold might be indicated whereas "allowable" presents an inflexible aspect. "Hygienic standards" is another proposed term. None of the proposed expressions has won complete accept-

ance, and, consequently, "M.A.C." is still heard wherever industrial hygienists gather, possibly because of our fondness for initials. A recent movement has considerable backing to use the same initials but to substitute "acceptable" for "allowable."

"Maximum acceptable concentration" would seem to have a good chance for widespread use because it indicates a standard in which the degree of hazard has been given some considera-

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## Encyclopedia of Industrial Hygiene Instruments

The University of Michigan Institute of Industrial Health and School of Public Health and the Public Health Service Occupational Health Program, Cincinnati, cooperated in the preparation of the Encyclopedia of Instrumentation for Industrial Hygiene. Technical editors are Charles D. Yaffe, Dohrman H. Byers, and Andrew D. Hosey of the Public Health Service.

The 1,243-page volume contains comprehensive information on the approximately 1,000 air-sampling instruments exhibited at the Symposium on Instrumentation for Industrial Hygiene, held at the university, May 24-27, 1954. It also contains 28 technical papers presented at the symposium.

Described are instruments for measuring air velocity and metering air, laboratory-type instruments of specific application to industrial hygiene, instruments specifically designed for atmospheric pollution evaluation and meteorological measurements, instruments for sampling and analyzing air for contaminants in industrial environments, and instruments for measuring sound and vibration, for measuring ionizing radiation, and for measuring ultraviolet, visible, and infrared energy.

Included for each instrument are a physical description, data on performance, and information on uses, operating principle, source, and price. In addition, there are photographs, wiring and schematic diagrams, and operating, calibrating, and maintenance instructions.

The encyclopedia was published by the university in April 1956 and may be ordered from the Publications Distribution Service, University of Michigan, Ann Arbor, Mich.

tion. If so, it might be well to point out that future use of M.A.C. will need to be accompanied with a definition of the intended meaning.

In conclusion I refer those interested to the following discussion of this point taken from "A Guide to Uniform Industrial Hygiene Codes or Regulations," which was issued a few years ago by the American Conference of Governmental Industrial Hygienists.

"Maximum concentrations shall not be used as the sole criterion for establishing evidence of hazard to health or well-being, but the evaluation of a possible hazard shall also be subject to other pertinent factors such as the nature of the contaminant and the frequency and duration of the exposure or clinical evidence of harmful effects.

"Thousands of elements, compounds, and mixtures are employed or encountered in places of employment, and the number of new ones being utilized is constantly increasing. Some of these have been found to injure health if present in the working atmosphere in excessive concentrations. Others, while not producing demonstrable injury, have been found to cause irritation, coughing, sneezing, objectionable breath, or other undesirable results.

"Through actual experience in industry, a great deal has been learned about the effects of some substances. This information has been supplemented by considerable laboratory research. The body of

knowledge regarding toxicity of substances is fairly large and is steadily increasing in size. Much more remains to be learned, however, not only about the newer materials but also about some which have been studied for many years. Honest differences of opinion as to the safe concentrations of some of the more common toxic materials exist among authorities in the field of industrial toxicology. Greater differences of opinion are naturally encountered with respect to the limits to recommend for substances on which there is more limited experience.

"Despite the gaps in our present state of knowledge, specific figures must of necessity be provided at least as a guide toward the definition of what constitutes a safe working atmosphere. Specific figures are desirable not only for the use of the authority in determining essential compliance with codal provisions but also are helpful to industry as benchmarks upon which it can base a design of control equipment which it plans to install. There are some who feel that specific figures should not be included unless there is a great deal of conclusive evidence to justify the figure established. However, if no figure is given for a substance because of the absence of positive proof, when question arises as to the presence of a suspected hazard, the authority must render a decision regardless of whether or not a specific value is contained in the code. Consequently, it is felt advantageous to make the list in the code as inclusive as is possible."

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## PHS Announcement

**Dr. Theodore J. Bauer**, formerly chief of the Public Health Service Communicable Disease Center in Atlanta, has been named deputy chief of the Bureau of States Services. He succeeds Dr. Leroy E. Burney, recently appointed Surgeon General of the Service.

With the Public Health Service since 1934, Dr. Bauer has served as venereal disease control officer for the Chicago Board of Health during 1942-48, and as chief of the Venereal Disease Division during 1948-53, when he was appointed to the Communicable Disease Center post.

He is a graduate of the University of Iowa liberal arts and medical schools.

# Hospital and Medical Facilities Survey And Construction Program

By JOHN W. CRONIN, M.D.

THE Hospital Survey and Construction (Hill-Burton) Program was instituted in August 1946. Its purpose is to make available adequate hospital, clinic, and similar services to all the people through a program of grants to States for survey and planning; and grants on a matching basis to assist in the construction of public and voluntary nonprofit hospitals, public health centers, and related facilities.

The facility must fill a community need and may be new construction or the remodeling or enlarging of existing facilities. The project sponsor must initiate the project and is responsible for its operation. The Federal Government provides financial assistance, sets minimum standards of construction, and, by law, is restricted from the selection of personnel in the operations or in the administration of the completed facility. All projects must be nonprofit or public in type which render a community service, and, in general, do not discriminate on basis of race, creed, or color.

The Medical Facilities Survey and Construction Amendments of 1954 authorized categorical funds for hospitals for the chronically ill and impaired; nursing homes; diagnostic centers or diagnostic and treatment centers; and, rehabilitation facilities.

Federal funds were appropriated to match State funds to survey the need for hospitals and

medical facilities prior to the utilization of the construction funds within the respective States.

As of May 1, 1956, the total estimated cost of all facilities approved amounted to \$2,284 million. The Federal contribution represents \$740 million and is matched by sponsors' funds amounting to \$1,544 million.

There have been 2,905 projects approved. Of these, 2,035 providing 94,566 beds have been completed and are in operation; 553 projects adding 24,915 beds are under construction; and 317 projects adding 11,580 beds are in the pre-construction stage. A grand total of 131,061 hospital beds, 619 public health centers and many adjunct facilities are provided.

The majority of all approved applications are for general hospitals—73 percent and 94,928 beds. Three percent are for mental hospitals—13,047 beds. Two percent are for tuberculosis hospitals—8,478 beds. Two percent are for chronic disease facilities—7,484 beds. Nineteen percent are for public health centers and one percent for other related health facilities.

Twenty percent of the total funds went to teaching institutions, including 37 university medical school hospital projects. Of the 1,057 new hospitals about 55 percent are located in towns under 5,000 population while only 11 percent are in cities of 50,000 or more people. The civil defense implications are obvious. Five hundred and thirty-five new general hospitals are located in areas which had no hospitals prior to the beginning of the program.

The total annual authorization of this program is \$210 million.

The estimated bed deficit in the United States and Territories as reflected by the official State Plans is 850,000 beds. Progress in alleviating this shortage is slow because of annual population increase and the physical and functional obsolescence of the Nation's existing hospital resources.

In 1955, \$1,200,000 of Federal funds were appropriated for research in hospital services, facilities, and resources by the Public Health Service and through grants for research and demonstration purposes. All of these funds have been awarded to qualified applicants. A total of 27 grants have been made.

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*Dr. Cronin is chief of the Division of Hospital and Medical Facilities, Public Health Service. This is a summary report based on a paper presented at the meeting of the section on preventive and industrial medicine and public health, American Medical Association, on June 14, 1956, at Chicago, Ill.*

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# Food Poisoning

## caused by the **GREAT BARRACUDA**



By SIDNEY PAETRO, M.P.H.

**D**URING the spring and summer of 1954, four incidents of illness following the consumption of fish were reported to the Broward County Health Department in Fort Lauderdale, Fla. The clinical manifestations of the illness and the results of laboratory and epidemiological investigations indicated that it was fish flesh poisoning, or ichthyosarcotoxism, resulting from ingestion of the great barracuda, *Syphraena barracuda*.

**May 13.** The first incident was reported on May 13 by a local physician. Five persons had eaten dinner at approximately 6 p. m. the day

before at a rooming house in Fort Lauderdale. The meal consisted of barracuda, succotash, eggplant, cole slaw, okra, mashed potatoes, banana pudding, hot rolls, coffee, and iced tea. All five persons became ill within 1 to 2 hours after they had eaten. Symptoms and complaints were nausea, diarrhea, metallic taste, and the unusual reactions of cold objects feeling hot and hot objects feeling cold, numbness of the arms and legs, and itchiness. Three pet cats fed only barracuda died within 24 hours.

The barracuda, estimated to weigh 6½ pounds, was caught in the Atlantic Ocean about 1½ miles off the coast of Fort Lauderdale near the 2-mile reef about 4 p. m. on May 11. It was placed in deep freeze soon after it was caught and kept there until the following evening, when it was prepared and then fried in a commercial shortening. One of the victims commented, "The fish was the prettiest, whitest, best tasting fish I ever ate."

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*Mr. Paetro is sanitarian for the South Broward District, Broward County Health Department, Fort Lauderdale, Fla. Investigation of the fish poisoning incidents was conducted by Richard L. Almeida, chief sanitarian of the department, and the author.*

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Three of the victims were hospitalized immediately. One was ill for 2 weeks, two for about a month, another for 6 weeks, the fifth remained in bed for 5 weeks and had after-effects of the illness when interviewed almost 4 months later.

Specimens of both the raw and the cooked fish were sent to the laboratory of the Florida State Board of Health on May 13. The laboratory reported that "no organisms commonly associated with food poisoning were isolated."

**June 27.** Of 10 persons who ate barracuda for dinner at a restaurant in the city of Pompano, 7 became ill in varying degrees. The victim interviewed stated that the onset of illness occurred approximately 4 hours after she had eaten and that she was hospitalized for 3 days. Symptoms included gastrointestinal disturbances similar to those reported in the first incident, temporary loss of speech, and partial loss of touch in the extremities.

In addition to barracuda, the meal consisted of cole slaw, green peas, french fried potatoes, pickled watermelon rinds, bread, butter, and beer. Three barracuda were eaten, all 3 weighing an estimated 15 pounds. They had been caught about 2 miles off Hillsborough Inlet, north of Pompano Beach. The fish were cleaned, brought to the restaurant, broiled, and served the same day caught. No specimens were available for laboratory analysis.

**July 9.** Between 6 and 7 p. m. a family of eight members ate a meal consisting of barracuda, cornmeal cakes, fried onions, corn on the cob, tossed green salad, cherry pie, and the usual drinks. All 8 became ill, and 5 were hospitalized. The illness occurred from 1 to 5 hours after the meal. A small amount of the fish was given to a neighbor, and a similar quantity was fed a pet dog during the meal. Both the neighbor and the dog became ill. The symptoms in all persons were similar to those previously reported.

The barracuda was caught off the Fort Lauderdale coast near the third buoy at approximately 7:30 a. m. There was no refrigeration aboard the vessel, but soon after the boat docked at 9:30 a. m., the fish was placed on ice. It was prepared and deep fried in fresh commercial shortening the same evening. Comments concerning the fish included, "Nothing unusual"

and "It looked beautiful and tasted delicious." A specimen of the fish which had been kept in deep freeze was sent to Dr. Bruce W. Halstead at the School of Tropical and Preventive Medicine, College of Medical Evangelists, Loma Linda, Calif. Dr. Halstead reported that tests on mice with this sample were "mildly symptomatic."

**August 24.** At approximately 6 p. m., a man, his wife, and their 4-year-old daughter consumed a meal of barracuda, tartar sauce, asparagus (frozen), salad, cookies, ice cream, and iced tea. The parents became ill in approximately 7 hours; the child, within 10 hours. They reported symptoms similar to those already described plus general weakness and a spicy taste to unspiced foods. The illness lasted 5 to 6 days.

The barracuda was caught, 7 weeks earlier, near the 3-mile reef off the Pompano and Boca Raton coast. It was estimated to weigh 15 pounds. On the day it was caught, a section had been given to a neighbor and the remainder placed in deep freeze. Discussing the illness with the neighbor, we learned that the neighbor and his wife had eaten the fish the day it was given to them and that they had both become ill. They were ill for 3 days.

One specimen of the frozen fish was submitted to the Florida State Board of Health laboratory, and another specimen was sent to Dr. Halstead. The State laboratory reported: "Organisms isolated culturally characteristic of the coliform group." Dr. Halstead reported that tests on mice with this sample "produced very severe symptoms in 1 mouse and 1 mouse died 27 hours after injection, which, according to our routine classification, would indicate that the barracuda sample was moderately toxic."

#### Health Department Action

It was not possible to obtain a list of foods each individual ate at each of the meals in question. However, a study of the lists of all foods prepared and served at each meal revealed that only one food, barracuda, was common to all.

The health department gave two news releases to the local newspapers during these

months. The first, on July 21, reported the occurrences of food poisoning recorded to that date and requested that the health department be notified should illness follow consumption of fish, particularly barracuda. The second, dated September 1, described the latest incident and urged that all instances of food poisoning be reported and that samples of suspected foods be preserved on ice for laboratory analysis. No reports were received after that of the August 24 episode.

During the course of the investigation, we gathered and studied numerous publications, research papers, and opinions in an effort to determine the cause of an illness the characteristics of which had never before been reported in this area. Presented below is some of the more pertinent information compiled from these sources.

### Characteristics of Fish Poisoning

Ichthyosarcotoxism is the technical term for intoxication resulting from the ingestion of the flesh of poisonous fish.

One of the first symptoms to develop is a tingling about the lips and tongue. The tingling soon spreads to the hands and feet and gradually develops into numbness. These symptoms may appear at any time within a period of 30 hours after ingestion of the fish. Gastrointestinal symptoms are said to be reported by about 75 percent of the victims (1). Some persons state that their hands and feet are without feeling, whereas others report that their hands and feet hurt when placed in water. Persons with very severe cases generally suffer impairment of movement and sometimes they are unable to walk or stand (2).

One of the most outstanding symptoms is the generalized sensory disturbance in which temperature sensations are reversed; that is, hot objects seem cold to the touch, and cold objects seem hot. This particular disturbance has been reported from many widely scattered areas of the world for more than 175 years.

Recovery from severe attacks of fish poisoning is usually very gradual. Symptoms of weakness sometimes persist for months after specific symptoms have disappeared. An at-

tack does not impart immunity, and there is no known specific antidote or antitoxin (1).

Clinical reports indicate that the ichthyosarcotoxins from many fish species are powerful neurotoxins. The symptoms are similar to those produced by such compounds as aconitine, muscarine, and curare (3).

There are four major types of ichthyosarcotoxism: ciguatera; Tetraodon, or puffer, poisoning; scombroid poisoning; and *Gymnothorax* poisoning. All of these have many characteristics in common, but they differ as to the predominance of certain types of symptoms. Ciguatera is the type thought to have caused the incidents reported to the Broward County Health Department.

Ciguatera, or Caribbean type fish poisoning, has been known for a number of centuries in the countries bordering the subtropical and tropical waters of the Caribbean Sea, the Atlantic Ocean, and the Pacific Ocean. Although numerous species of fish produce this type of poisoning, one of the common causative species is the *Sphyraena barracuda*.

Ciguatera is considered the least virulent form of fish poisoning. The mortality rate has been estimated to be 2 or 3 percent. Complete recovery from the weakness and myalgia can be a matter of weeks or months (3). Records indicate that not all persons who eat poisonous fish become ill, but one attack of ciguatera does not impart immunity to subsequent attacks.

Besides the usual symptoms of fish poisoning, ciguatera has these characteristics:

1. The onset occurs from 1 to 10 hours after ingestion of the fish.
2. There is a distinct metallic taste in the mouth.
3. There is a tingling sensation and itchiness which may last for days (4).
4. Malaise, chills, fever, prostration, profuse sweating, generalized motor incoordination, muscular weakness, and joint aches are common (3).
5. Cramps may occur in the extremities (4).

### Theories Regarding the Cause

Many theories regarding the cause of fish poisoning have evolved over the centuries. Following are some of these theories and the opin-

ions of scientists who have done research in this field.

### *Food-Chain Theory*

According to the food-chain theory of fish poisoning, the flesh of fish is made toxic by the consumption of poisonous plants or animals, such as manchineel berries, certain algae, dinoflagellates and other marine invertebrates, jellyfish, corals, swarming palolo worms, mollusks, and crabs.

Halstead and Bunker state that if this theory is correct, the distribution of the toxin within the fish is probably governed by three principal factors: venous draining of the intestine, detoxication, and metabolic processes of the fish (5). Therefore, a high concentration of the "toxin" should be found in the liver and intestine and a low concentration in the somatic muscle if the fish is captured soon after feeding, and the reverse situation if the fish is caught at a later time.

Hiyama tested organ and muscle tissue of poisonous fish in feeding experiments (2). He did not find that the poison was limited to any particular organ, but he did find that muscle tissue produced the most obvious indication of poisoning. On examination of the stomach contents of poisonous fish, he found neither seaweed nor fragments of echinoderms, but unidentifiable digested remains of small fish. Examination of fish collected in areas inhabited by poisonous crabs showed that most of the fish had been feeding on small siganids; no crab fragments were found. In his opinion, there was no connection between feeding habits and toxicity of the fish.

Poisonous fish have been found at all depths of the ocean; therefore, nothing valid can be deduced from their living habits.

### *Copper-Contaminated Waters*

The theory that fish may become poisonous from underwater deposits of copper, copper-lined bottoms of sunken vessels, or war materials containing copper has received some attention. The copper compounds, according to this theory, are absorbed by the fish and become a part of its body composition, making the fish toxic.

Arcisz considered this theory improbable

since all fish caught near copper banks are not toxic, and, conversely, toxic fish are found where there are no known copper banks (4). The same logic can be applied to sunken vessels or war materials found on the ocean bottom.

### *Size, Sex, and Development*

Many investigators consider the size of the fish an important factor in fish poisoning. They regard large fish as generally more toxic than small ones of the same species. A few authorities believe that small fish are never toxic (4). However, little dependable information is available in this regard.

Hiyama was unable to detect any variation in toxicity with sex of the fish, but he observed a variation in toxicity with age in a number of different species (2). Phillips and Brady believe that sexual maturity is not necessarily a factor in toxicity (6).

### *Bacterial Contamination*

Another theory holds that the toxin is produced as a result of bacterial contamination. The contamination may be on or in the fish before it is caught, or it may be introduced during handling or processing after it is caught.

In studying ichthyosarcotoxism, Halstead and Lively found that the freshness of fish had no relation to virulence of the toxin (3). Cohen and his colleagues (7) and Yasukawa (8) do not believe that the toxic agent is of bacterial origin.

### *Endogenous Theory*

Yasukawa found that the location of the poison varied with different species of fish (8). It is found chiefly in the gonads, particularly in the ovaries, and sometimes in the liver. In his opinion the toxin is not produced until the fish reaches maturity and is most virulent in its action during the spawning season.

Tani found that the toxicity of the puffer was highest during the spawning season of the year (9). The toxicity reached a peak a short time before the spawning season, continued at the same level for a few weeks after spawning, and then gradually declined.

It is known that the reproductive organs and roe of certain fish may be poisonous, but

Phillips and Brady are of the opinion that these cannot contaminate the flesh of the fish directly (6).

### An Unexplained Phenomenon

None of these theories would seem to explain why the consumption of barracuda caught off this part of the east coast of Florida in the spring and summer of 1954 resulted in illness. Hundreds of the same species of fish were caught in the same waters during the same period and were eaten without harmful effects. Barracuda from these waters have been eaten in the years before and since; yet no other illnesses of a similar nature are on record.

On the basis of the food-chain theory of fish poisoning, the possibility that the incidents were associated with the phenomenon known as red tide was considered early in the investigation. It was dismissed, however, when we learned that the dinoflagellate responsible for red tide, *Gymnodinium brevis*, has never been observed along the eastern coast of Florida, although it is found periodically along the Gulf Coast.

It is earnestly hoped that research on fish flesh poisoning will be intensified so that outbreaks such as those described here can be prevented. Basic knowledge is needed regarding the factors that cause the flesh of sometimes edible fish to become poisonous, the chemical and pharmacological properties of the toxins, and

means by which poisonous fish can be recognized.

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# Infectious Hepatitis, Diarrhea, and Typhoid Fever

By GILBERT V. LEVIN, M.S., and HOWARD WEST, M.P.H.

A NUMBER of cases of infectious hepatitis, diarrhea, and typhoid fever occurred during the period August 1954 to April 1955 within a six-block radius in Washington, D. C. Circumstances surrounding the earliest known cases indicated that the diseases might be linked to a common source, a contaminated water supply. Consequently, a three-disease epidemiological study of the approximately 7,000 persons in the area was undertaken by the District of Columbia Department of Public Health.

The incident that first attracted the attention of the investigators to this unusual chain of events took place during the week of January 3, 1955. Seven cases of diarrhea occurred among members of four households occupying a building in the 400 block of Sixth St., SW. The only person in the building who did not have the disease was a 6-month-old infant for whom all water had been boiled. The exist-

ence of yard hydrants and yard water closets in this neighborhood heightened suspicion that the water supply had been contaminated. These obsolete plumbing fixtures cross-connect the water supply with the sewer line so that fresh water standing in the riser pipes can drain into the sewer to prevent freezing in the pipes during the winter. Experience in the District of Columbia and elsewhere (1, 2) has shown that under certain conditions sewage can enter the water supply through the cross connections.

Beginning on January 13, the date the outbreak was reported to the health department, a week-long series of 26 water samples was taken from the area. Two of these samples, one from the building where the outbreak took place and one from an adjacent building, were positive for coliform organisms. Free available chlorine of 0.2 p.p.m. or more was present in all the 26 samples except 3 which came from the buildings producing the coliform-positive samples. The chlorine demand thus demonstrated in this restricted area was further evidence of local contamination of the water supply.

A detailed plumbing survey revealed the presence of numerous yard hydrants and yard water closets in the neighborhood. Many of them were defective. Since the four households had no social contact, were served by different dairies, and had individual kitchen facilities, the circumstantial evidence indicated that the outbreak was waterborne.

During the week of January 25, a case of infectious hepatitis occurred just four doors away from the scene of the diarrhea outbreak. This

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*Mr. Levin, now civil defense representative for the District of Columbia Department of Public Health, was public health engineer with the department's bureau of public health engineering when the study reported here was conducted. Mr. West has been chief of the biostatistics and health education division of that department since February 1954. He was formerly chief of the Statistical Processing Branch, National Office of Vital Statistics, Public Health Service.*

*Dr. Ralph Paffenbarger, epidemiologist with the Public Health Service, provided technical guidance in making the study and in preparing the report.*

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aroused the suspicion that there might be a connection between the two incidents. Infectious hepatitis has been known to be water-borne (3-10).

The infectious hepatitis patient was a school child. Inquiry at the school revealed three other cases, and a check with 13 other schools in Southwest and Southeast Washington, four more cases. A sanitary survey of the two schools involved disclosed nothing to indicate that the disease was being spread by conditions at the schools.

The 8 infectious hepatitis patients and the 7 diarrhea patients all lived within a radius of 6 blocks in Southwest Washington. Also within this area were located three cases of typhoid fever which had occurred in the fall of 1954.

### Case-Finding Survey

To determine if an epidemic of one or more of the three diseases was in progress, the health department conducted a case-finding survey March 2-16, 1955. Interest now centered about infectious hepatitis, which is not a reportable disease in the District of Columbia. As the normal incubation period of infectious hepatitis ranges from 15 to 35 days, it was decided to request information back to Thanksgiving Day, November 25, 1954, approximately one maximum incubation period before the date of onset of the earliest known case and a convenient mental landmark.

The area selected for the survey, shown in figure 1, was the smallest considered likely to yield conclusive results. Its 27 city blocks encompassed the locations of the known cases of the three diseases.

Interviews were held with members of 1,579 households out of the 1,955 households in the area, yielding information on 5,519, or 81 percent, of the estimated 6,800 persons living in the area.

Ratios of yard hydrants and yard water closets to the population were determined for possible correlation with attack rates of the three diseases. Information on yellow eyes or skin, white or gray stools, and abdominal tenderness was requested from the interviewees. Positive information regarding the first or second item, together with an associated illness of plausible

duration, was considered a probable case of infectious hepatitis. Only cases diagnosed and verified by physicians were classed as definite cases of infectious hepatitis.

The portion of the city in which the survey

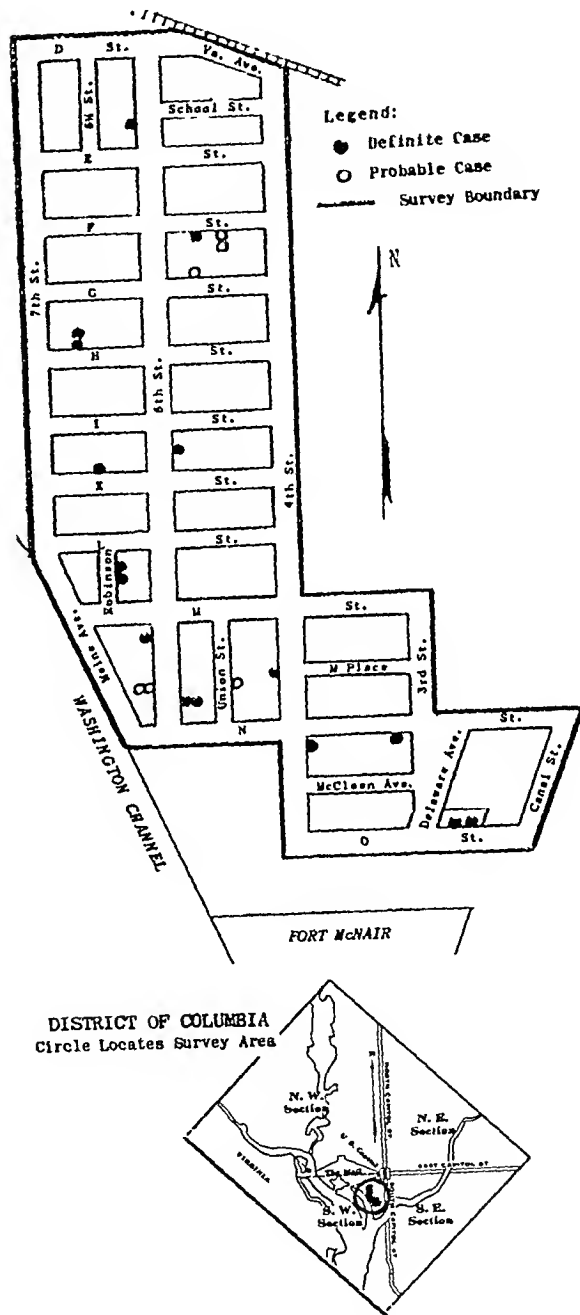


Figure 1. Distribution of infectious hepatitis cases within survey area, Washington, D. C., November 25, 1954–March 10, 1955

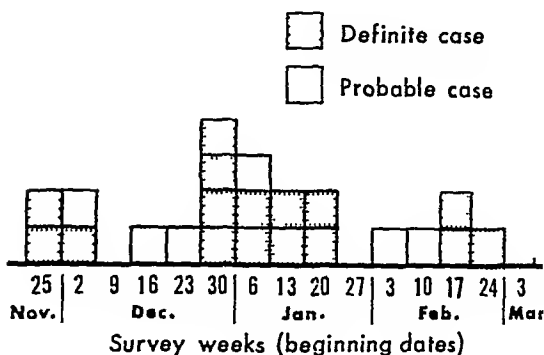
area is located is of low socioeconomic status and is characterized as "blighted" to "slum." Most of the buildings are old, two-story, brick, row houses that have been converted into tenements. There are small stores and shops on some of the streets, but no large industrial plants. The area is primarily residential and is inhabited by both the Negro and white races, with Negroes predominating.

The survey area had a population density of approximately 43,200 persons per square mile. Age, race, and sex distributions of the surveyed population are given in table 1. Of the 1,579 households, 27.4 percent had outdoor plumbing fixtures. The households served by outdoor plumbing comprised 1,608 persons, 29.2 percent of the surveyed population.

### Infectious Hepatitis

Sixteen definite and six probable cases of infectious hepatitis occurred in the survey area between November 25 and March 10. There was no correlation between incidence and outdoor plumbing. On the contrary, there was strong evidence that the outbreak was propagated by contact. This was demonstrated by a comparison of two ratios: (a) the number of infected persons reporting contact to the total number of infected persons and, (b) the number of noninfected persons reporting contact to the total number of noninfected persons. These ratios expressed as percentages proved to be

Figure 2. Incidence of infectious hepatitis in survey area, Washington, D. C., November 2, 1954–March 10, 1955



23.9 and 0.1, respectively; thus, the rate of contact was 239 times as great for those who had the disease as for those who did not.

The distribution of the cases by date of onset is given in figure 2. It is typical for contact spread. Distribution of the cases by location is shown in figure 1.

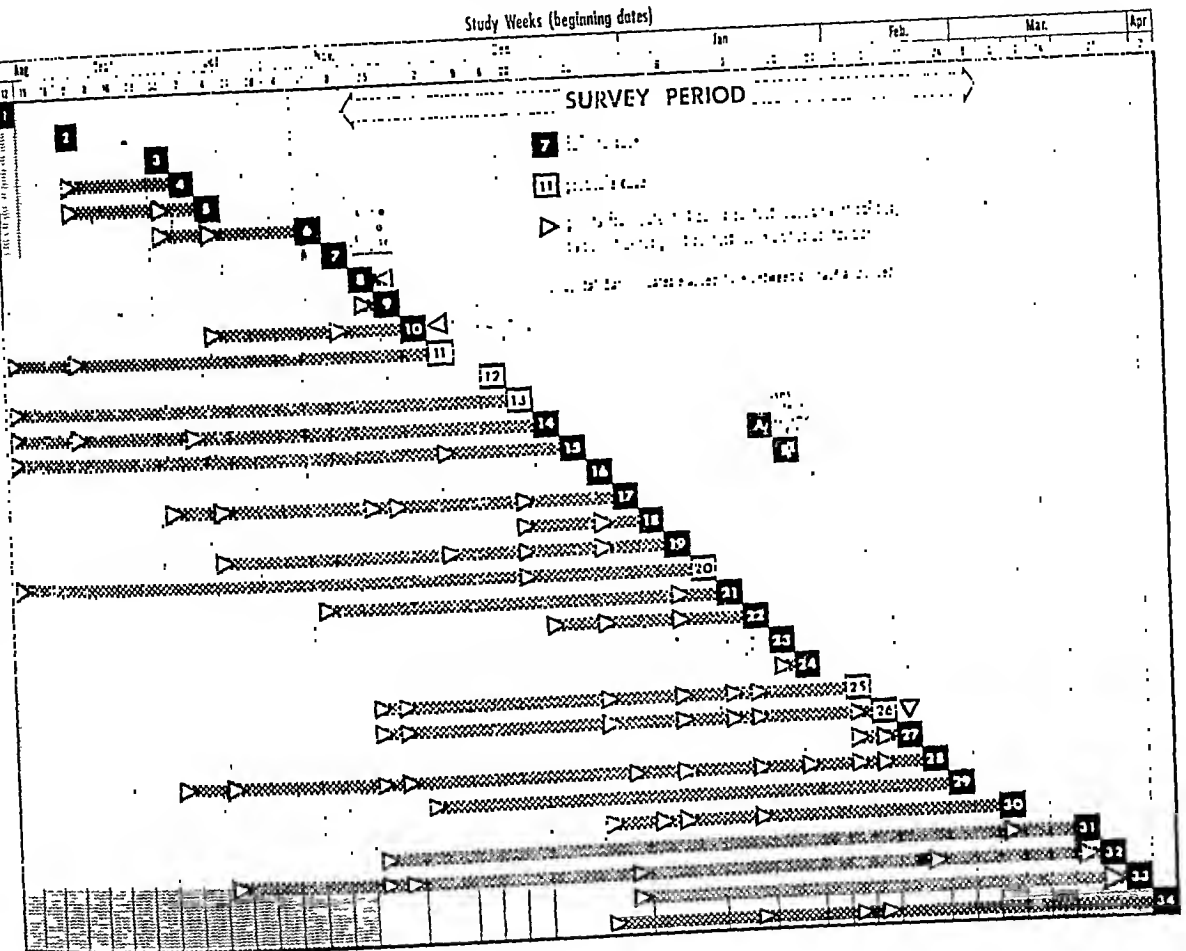
The most striking fact about the outbreak is that it was almost completely confined to white children under 15 years of age. Fourteen of the 16 definite cases and 2 of the 6 probable cases occurred among that group. The number of white children under 15 years of age in the survey area was 620. Thus, the attack rates for that group for the survey period were 2,260 per 100,000 for definite cases and 2,900 for definite plus probable cases.

Table 1. Age, race, and sex distribution of the surveyed population

Age (in years)	Total	White				Negro				Race not stated			
		Total	Male	Female	Sex not stated	Total	Male	Female	Sex not stated	Total	Male	Female	Sex not stated
Total	5,519	2,047	995	1,039	13	3,216	1,433	1,779	4	256	130	125	1
Under 5	719	208	105	102	1	476	238	238	0	35	16	19	0
5-9	710	242	111	131	0	440	214	226	0	28	15	13	0
10-14	489	170	93	77	0	303	134	169	0	16	10	6	0
15-24	656	233	97	136	0	398	152	246	0	25	13	12	0
25-34	657	245	126	119	0	375	145	230	0	37	18	19	0
35-44	758	284	135	149	0	441	181	260	0	33	14	19	0
45-54	595	224	116	108	0	336	151	185	0	35	20	15	0
55-64	414	184	94	90	0	213	110	103	0	17	9	8	0
65 and over	329	168	82	86	0	147	69	78	0	14	6	8	0
Not stated	192	89	36	41	12	87	39	44	4	16	9	6	1



Figure 3. Chain of "potential contacts" for the 34 cases of infectious hepatitis occurring in the survey area, August 12, 1954-April 14, 1955



The crude attack rate for definite cases was 290 per 100,000 population for the 15-week period; it was 400 for definite plus probable cases. Annual attack rates for reported infectious hepatitis cases in 14 major cities in the United States in 1954 ranged from 5.4 to 141.0 per 100,000 population. Of course, attack rates based on reported cases cannot be compared with rates based on an intensive survey. They are included only to indicate the general level of incidence of the disease.

Four secondary cases occurred during the survey period, 2 definite and 2 probable cases. Eighty-two persons were risks to secondary infections (members of a household in which a primary case occurred) for definite cases, and 105, for definite or probable cases. Thus, the secondary attack rates for the survey period

were 24.4 per 1,000 for definite cases and 38.1 per 1,000 for definite plus probable cases. The ratios of secondary to primary attack rates were 9.6 and 11.7 for definite and definite plus probable cases, respectively. Three of the four secondary cases occurred within 2 weeks of the primary cases. The fourth occurred 12 weeks after its primary case.

In light of the findings of the case-finding survey, the health department made a case-and-contact survey shortly thereafter. An additional 12 definite cases were discovered to have occurred within the bounds of the survey area from August 12 through April 14, giving totals of 28 definite cases and 34 definite plus probable cases for this period. No rates, of course, can be inferred from these numbers since it is unlikely that they include all cases occurring be-

Table 2. Chronology of infectious hepatitis cases by communal place, September 2, 1954-April 6, 1955

Communal place	Week number																																
	1	2	3	4	5	6	7	8	9	10	11	12	Survey period															28	29	30	31		
														13	14	15	16	17	18	19	20	21	22	23	24	25	26	27					
School A	2					4												{14 15}															
School B							5						8																				{31 32 33}
School C																	13	17															
Club A																	13			22													
School D																		16	{18 19}	{22 21}				25		{27 28}		30					
Club B																					{23 24}		25	26									

<sup>1</sup> Probable case.

fore or after the survey period. The earliest known case associated with the outbreak was that of a woman who worked in a grocery store in the area. While in the store, she had contact with many of the children in the neighborhood; in her case history, she cited four who later became ill.

Analysis of the contact information showed a surprisingly complete chain of "potential contacts" within the limited survey area. A person was considered to be a potential contact if he was named as a contact by a person who had a definite or probable case of infectious hepatitis and if he too was found to have had a definite or probable case. To elicit the maximum contact information from the interviewees, questions were asked regarding persons in the following categories: acquaintances who had had infectious hepatitis since September 6; other patients and their contacts known personally by the interviewee (usually schoolmates); visitors to the patient during his illness; persons associated with the patient in the home environment within 3 days before or 3 days after date of onset. The potential contact chain for the 34 definite and probable cases is shown in figure 3.

For 27 of the 34 cases, the contact information revealed one or more possible sources of infection among members of the group. Only two of the potential donors of the disease lived out-

side the survey area. These facts are a strong indication that the outbreak was confined largely to the survey area. A check with the schools attended by the infectious hepatitis patients, which also draw students from outside the survey area, supported this contention. As shown in figure 1, the survey area has several isolating boundaries: the railroad on the north, the Washington Channel on a portion of the western border, and a military reservation just beyond the southern limit. Several blocks to the east, the buildings had been torn down in a slum clearance project.

When the applicable cases were grouped chronologically by communal places (schools or clubs of which two or more members had the disease), table 2 resulted. These data show that the disease progressed in a fashion typical of contact. Twenty-three of the thirty-four patients were members of six such groups. Intracommunal group contact can be traced by referring to figure 3.

According to available figures, 9.0 to 9.9 percent of all dwelling units in an area similar to, and including, the survey area provide less than 39 square feet of sleeping space per person. For the 30 households in which infectious hepatitis occurred, the percentage was 16.6. For the 6 households in which secondary cases occurred, the figure was 50 percent. (Two secondary cases occurred prior to the period covered by the original survey.) This indicates, as

might be expected, a correlation between incidence of secondary cases and crowding.

All the cases among school children occurred in the white population although the schools are not segregated. Only two definite cases and one probable case, all in persons over 27 years of age, occurred among the large Negro population of the area. These facts arrest attention, but there are two possible explanations. First, classroom contact may not be close enough for spread of the disease, which may take place in more intimate, and still generally segregated, extracurricular activity groups. Second, jaundice is more difficult to recognize and to diagnose in Negroes than in whites. The possibility that the diagnosis and treatment facilities available to the two groups were unequal is not supported by records for the medically indigent of the area.

### Diarrhea

Fifty-eight persons had diarrhea during the 15-week survey period, November 25 to March 10, a crude attack rate of 1,050 per 100,000 population. None of these persons knowingly had either infectious hepatitis or typhoid fever during that period. With the exception of the initial outbreak of 7 cases, none of the cases were attributable to outdoor plumbing. On the basis of appropriate population adjustment, diarrhea attacked four times as many whites as Negroes. No explanation for this has been evolved.

The secondary attack rate for diarrhea was 134 per 1,000 exposed persons in the surveyed population. The ratio of the secondary attack rate to the primary attack rate was 15.7, indicating that intrafamilial contact was a potent factor in the spread of this disease.

### Typhoid Fever

No cases of typhoid fever occurred during the period covered by the survey. However, the surprisingly large number of 74 persons reported that they had had typhoid fever at some time in the past. Of these, 40.3 percent were served by outdoor plumbing at the time of the survey, as compared with 29.2 percent for the total population. Since many of the 74 had typhoid fever in other homes or even in other

cities, these figures do not indict the plumbing as the source of their disease, but they are of epidemiological significance from the standpoint of typhoid fever carriers.

A check of all available typhoid fever registers in the department of public health yielded records on only 5 of the 74 persons. They were listed as noncarriers. But what about the remaining 69, many of whom live in homes with outdoor plumbing? Furthermore, the finding of these 74 persons, coupled with a knowledge of plumbing conditions in similar areas, implies that there are a large number of persons in the city who have had typhoid fever and who are currently living in dwellings served by outdoor plumbing. That carriers among them pose a real threat is suggested by the fact that during the past 10 years an annual average of 14 cases of typhoid fever has been reported in the District of Columbia.

A 7-year-old girl and 5- and 7-year-old sisters living a block away from her made up the group of three typhoid fever cases reported in the fall of 1954. None had drunk any water other than from the municipal supply within 30 days prior to onset of the disease. The first girl became ill on September 29. She gave a history of contact with the two sisters within 3 days of that date. The other 7-year-old girl became ill on October 8, and her sister, on November 21.

The mother and a relative of the first of the girls had typhoid fever several years ago. Stool specimens from both had been examined in October 1954 and found to be negative for organisms of the *Salmonella* or *Shigella* groups. A test of a specimen from the relative in August 1955 was also negative.

Both households in which the three typhoid fever cases occurred have outside plumbing, and general household sanitation is very poor.

### Summary

Circumstantial evidence suggested that contamination of the water supply through outdoor plumbing was responsible for the spread of infectious hepatitis, diarrhea, and typhoid fever in a small area of Washington, D. C., in late 1954 and early 1955. Investigation showed that, although one outbreak of diarrhea was

probably waterborne, contact was the major factor in most cases of the three diseases.

The infectious hepatitis was confined almost entirely to white children under the age of 15 years. The rate of personal contact with prior cases was significantly higher for persons who had the disease than for those who did not. A nearly complete chain of contact among the patients was traced within the survey area.

Data on sleeping space per person indicated a relation between the incidence of secondary cases of infectious hepatitis and crowding.

An unexpectedly large number of persons who had once had typhoid fever were found in the survey area. Poor sanitary and plumbing conditions, as well as contact, were associated with three cases of typhoid fever reported in the fall of 1954.

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*Details of the study plan and procedures and the forms used in the surveys are available from the authors.*

#### REFERENCES

- (1) National Research Council, Sanitary Engineering Committee: Report on cross-connections. *J. Am. Water Works A.* 37: 427-441, May 1945.
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- (5) Gauld, R. L.: Epidemiological field studies of infectious hepatitis in the Mediterranean Theater of Operations. *Am. J. Hyg.* 43: 255-272, May 1946.
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## No Proof of Actual Harm Required In Water Pollution Abatement Action

The Appellate Court of Illinois recently held that, under a statute which defined pollution as including the "alteration of the physical, chemical or biological properties of water," the discharge by a municipality of untreated sewage into the Big Muddy River was subject to abatement by order of the Illinois State Sanitary Water Board on proof that such discharge adversely affected bacterial life normally present in the water. There was also testimony that the sewage discharge resulted in conditions detrimental to fish life.

The court rejected the argument that the board had no power to act except to abate a common law nuisance or without at least a showing of actual harm to fish or of human illness. Such restrictions, the court held, al-

though applicable to private suits, could not limit the board's powers to prevent pollution before actual harm resulted.

This is the first reported case involving the definition of "pollution" contained in the "Suggested State Water Pollution Control Act" (published by the Public Health Service in 1950), which was closely followed in the Illinois statute. *City of Murphysboro v. Sanitary Water Board of Ill.* 134 NE 2d 522 (4th Dist., Ill., 1956).

The "Suggested State Water Pollution Control Act" was endorsed by the Council of State Governments and recommended to the States in the council's "Suggested State Legislation; Program for 1951" issued in November 1950.

# Sanitary Engineering Degrees Awarded in 1955

EDMUND J. LAUBUSCH, M.S., and  
IRVING F. LUDWIG, M.S.

FOR the academic year 1954-55, there were 141 graduates from undergraduate sanitary engineering courses in the United States. In this same period, there were 145 graduate degrees conferred: 134 master's and 11 doctor's. For the academic year, July 1954-June 1955, covers the academic year, August 1954, February 1955, and June 1955.

Mr. Laubusch, now with the Chlorine Institute, Inc., was formerly senior assistant sanitary engineer, and Mr. Ludwig is sanitary engineer director, Division of Sanitary Engineering Services, Public Health Service.

The institutions offering sanitary engineering training at various academic levels and the numbers of degrees conferred are shown in the table. Similar data for the 62-year period 1889-1950 are available in the literature (1).

## Undergraduate Degrees

All but 12 of the 44 colleges and universities reporting the availability of undergraduate sanitary engineering training had graduates. For the academic years 1952-53 and 1953-54, the numbers of graduates were 216 and 164, respectively. The average number of graduates per year for the previous 5-year period, 1950-54, was 225.

## Master's Degrees

Of the 134 master's degrees awarded in 1955, 100 were awarded to United States citizens. Twenty, or about 37 percent, of the colleges and universities reporting the availability of graduate sanitary engineering training at this academic level had no graduates. For the aca-

Engineering degrees awarded in 1955 to persons with sanitary engineering training, United States

Institution	Doctor's	Master's	Bachelor's	Institution	Doctor's	Master's	Bachelor's
Alabama Polytechnic Institute		0		Michigan College of Mining and Technology <sup>5</sup>		1	
Alabama, University of		10	1	Michigan State College	0	2	
Arkansas, University of		1		Michigan, University of	0	8	
California Institute of Technology	20	30	4	Minnesota, University of	0	4	
California, University of	0	12	0	Mississippi State College		0	1
Case Institute of Technology	0	1		Missouri School of Mines and Metallurgy	20	70	
Connecticut, University of		0	0	Missouri, University of	0	32	
Cornell University	1	0	0	New York University		8	
Florida, University of	(4)	0	4	Newark College of Engineering		73	
Georgia Institute of Technology	0	1	4	North Carolina State College <sup>6</sup>		2	
Harvard University	5	24		North Carolina, University of		5	
Idaho, University of		31		North Dakota, University of			
Illinois Institute of Technology		0		Northwestern University	0	0	
Illinois, University of <sup>5</sup>	0	2	6	Ohio State University <sup>5</sup>	0	0	
Iowa State College <sup>6</sup>	0	0	3	Oklahoma Agricultural and Mechanical College <sup>6</sup>	100	1	
Iowa, State University of	0	1	4	Oklahoma, University of		8	
Johns Hopkins University	2	6	2	Oregon State College <sup>4</sup>	0	1	
Kansas, University of		10		Oregon State University <sup>5</sup>	0	1	
Kentucky, University of		70	0	Pennsylvania State University <sup>5</sup>	1	4	
Maine, University of		70	24	Purdue University	0	0	
Manhattan College				Rensselaer Polytechnic Institute			1
Massachusetts Institute of Technology <sup>5</sup>	2	12	4	Rutgers University <sup>5</sup>			

See footnotes at end of table.

**Engineering degrees awarded in 1955 to persons with sanitary engineering training, United States—Continued**

Institution	Doc- tor's	Mas- ter's	Bach- elor's	Institution	Doc- tor's	Mas- ter's	Bach- elor's
Santa Clara University.....			0	Utah Agricultural College.....			2
South Dakota State College.....		0	2	Utah, University of.....		<sup>3</sup> 1	
Southern California, University of.....		<sup>3</sup> 1	4	Virginia Polytechnic Institute.....	0	2	4
Tennessee, University of.....		0	2	Washington, State College of.....	0	0	0
Texas, Agricultural and Mechan- ical College of <sup>6</sup> .....	<sup>2</sup> 1 0	<sup>3</sup> 12 2	1	Washington, University of <sup>8</sup> .....	0	4	0
Texas, University of.....	<sup>2</sup> 0	<sup>13</sup> 6	2	West Virginia University.....		<sup>7</sup> 0	1
Tulane University.....		<sup>3</sup> 0	2	Wisconsin, University of.....	0	<sup>3</sup> 5	5
				Total.....	11	134	141

Leaders (-----) indicate no courses offered at this level.

<sup>1</sup> Master's in engineering with major in sanitary engineering. <sup>2</sup> Doctor's in civil engineering with major in sanitary engineering. <sup>3</sup> Master's in civil engineering with major in sanitary engineering. <sup>4</sup> Doctor's in sanitary engineering starting September 1955. <sup>5</sup> Has an undergraduate sanitary engineering curriculum. <sup>6</sup> Sanitary engineering courses are available as electives rather than as an option to the civil engineering program. <sup>7</sup> Master's in civil engineering with sanitary engineering electives or minor. <sup>8</sup> One "sanitary engineer" degree awarded (same as science degree except creative research not required). <sup>9</sup> One professional degree awarded; no thesis required. <sup>10</sup> Doctor's in engineering with specialization in sanitary engineering. <sup>11</sup> Doctor's in municipal and sanitary engineering. <sup>12</sup> Master's in municipal and sanitary engineering. <sup>13</sup> Also includes master's in civil engineering with major in sanitary engineering and master's in mechanical with major in sanitary engineering.

demic years 1952-53 and 1953-54, the numbers of graduates receiving master's degrees were 102 (20 by foreign nationals) and 120 (25 by foreign nationals) respectively. The average number of master's degrees conferred per year for the previous 5-year period, 1950-54, was 125.

#### Doctor's Degrees

Nine of the 11 doctor's degrees conferred during this period by four institutions were to United States citizens. Twenty-four other institutions offering sanitary engineering training at this academic level had no successful candidates this year. For the academic years 1952-53 and 1953-54, the numbers of graduates receiving

doctor's degrees were 5 (3 by foreign nationals) and 9, respectively. In the previous 5-year period, 1950-54, the average number of doctor's degrees conferred per year was 6.8.

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NOTE: Multilithed copies of this continuing report on sanitary engineering degrees, covering the years 1952-54, are available from the Division of Sanitary Engineering Services, Public Health Service.



# Milk Sanitation Honor Roll for 1954-56

Thirty-four communities have been added to the Public Health Service milk sanitation "honor roll" and 69 communities on the previous list have been dropped. This revision covers the period from July 1, 1954, to June 30, 1956, and includes a total of 251 cities and 39 counties.

Communities on the "honor roll" have complied substantially with the various items of sanitation contained in the milk ordinance suggested by the United States Public Health Service. The State milk sanitation authorities concerned report this compliance to the Public Health Service. The rating of 90 percent or more, which is necessary for inclusion on the list, is computed from the weighted average of the percentages of compliance. Separate lists are compiled for communities in which all market milk sold is pasteurized, and for those in which both raw milk and pasteurized milk is sold.

The suggested milk ordinance, on which the milk sanitation ratings are based, is now in effect through voluntary adoption in 427 counties and 1,603 municipalities. The ordinance also serves as the basis for the regulations of 34 States and 2 Territories. In 11 States and the 2 Territories it is in effect statewide.

The ratings do not represent a complete measure of safety, but they do indicate how closely a community's milk supply conforms with the standards for grade A milk as stated in the suggested ordinance. High-grade pasteurized milk is safer than high-grade raw milk because of the added protection of pasteurization. The second list, therefore, shows the percentage of pasteurized milk sold in a community which also permits the sale of raw milk.

Although semiannual publication of the list is intended to encourage communities operating under the suggested ordinance to attain and

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*This compilation is from the Division of Sanitary Engineering Services of the Bureau of State Services, Public Health Service. The previous listing was published in Public Health Reports, March 1956, pp. 327-330. The rating method was described in Public Health Reports 53: 1386 (1938). Reprint No. 1970.*

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maintain a high level of enforcement of its provisions, no comparison is intended with communities operating under other milk ordinances. Some communities might be deserving of inclusion, but they cannot be listed because no arrangements have been made for determination of their ratings by the State milk sanitation authority concerned. In other cases, the ratings which were submitted have lapsed because they were more than 2 years old. Still other communities, some of which may have high-grade milk supplies, have indicated no desire for rating or inclusion on this list.

The rules for inclusion of a community on the "honor roll" are:

1. All ratings must be determined by the State milk sanitation authority in accordance with the Public Health Service rating method, which is based upon the grade A pasteurized milk and the grade A raw milk requirements of the Public Health Service milk ordinance. (A departure from the method described consists of computing the pasteurized milk rating by weighting the pasteurization plant rating twice that of the raw milk intended for pasteurization.)

2. No community will be included

on the list unless both its pasteurized milk and its retail raw milk ratings are 90 percent or more. Communities in which only raw milk is sold will be included if the retail raw milk rating is 90 percent or more.

3. The rating used will be the latest submitted to the Public Health Service, but no rating will be used which is more than 2 years old. (In order to promote continuous rigid enforcement rather than occasional "cleanup campaigns," it is suggested that when the rating of a community on the list falls below 90 percent, no resurvey be made for at least 6 months. This will result in the removal of the community from the subsequent semiannual list.)

4. No community will be included on the list whose milk supply is not under an established program of official routine inspection and laboratory control provided by itself, the county, a milk control district, or the State. (In the absence of such an official program there can be no assurance that only milk from sources rating 90 percent or more will be used continuously.)

5. The Public Health Service will make occasional check surveys of cities for which ratings of 90 percent or more have been reported by the State. (If the check rating is less than 90 percent, but not less than 85, the city will be removed from the 90-percent list after 6 months unless a resurvey submitted by the State during this probationary period shows a rating of 90 percent or more. If the check rating is less than 85 percent, the city will be removed from the list immediately. If the check rating is 90 percent or more, the city will be retained on the list for 2 years from the date of the check survey, unless a subsequent rating during this period warrants its removal.)

**Communities awarded milk sanitation ratings of 90 percent or more, July 1954-June 1956**

**100 PERCENT OF MARKET MILK PASTEURIZED**

<i>Community</i>	<i>Date of rating</i>	<i>Community</i>	<i>Date of rating</i>	<i>Community</i>	<i>Date of rating</i>
<i>Arizona</i>		<i>Indiana—Continued</i>		<i>Kentucky—Continued</i>	
Phoenix.....	11-21-1955	Calumet region.....	5-26-1955	Newport and Campbell County.....	10-20-1955
<i>Arkansas</i>		East Chicago.....		Owensboro.....	5-17-1956
Fort Smith.....	8-26-1954	Gary.....		Paducah.....	8- 5-1955
<i>Colorado</i>		Hammond.....		Paris and Bourbon County.....	5- 3-1956
Boulder County.....	2-25-1955	Crawfordsville.....	4-20-1955	Stanford.....	12- 2-1955
Colorado Springs.....	1-19-1956	Elkhart, Goshen, Nappanee area.....	1-11-1956	<i>Louisiana</i>	
Denver.....	10-28-1955	Evansville.....	12- 3-1954	Calcasien Parish.....	8.....1954
Pueblo County.....	2- 2-1956	Greencastle.....	1- 4-1956	Lincoln Parish.....	9.....1954
<i>District of Columbia</i>		Indianapolis.....	9-15-1954	St. Martin Parish.....	7.....1954
Washington.....	3-12-1956	La Fayette and West Lafayette.....	10-14-1954	Vermilion Parish.....	9.....1954
<i>Florida</i>		Lake County.....	5.....1955	<i>Mississippi</i>	
Jacksonville.....	8-27-1954	Crown Point Highland Hobart.....		Clarksdale.....	10-13-1954
<i>Georgia</i>		Madison.....	8.....1955	Eupora.....	2-23-1956
Albany.....	12-16-1954	Monticello.....	12- 6-1955	Greenville.....	9-14-1954
Athens-Clarke County..	4- 8-1955	Mount Vernon.....	10-18-1954	Greenwood.....	4-25-1956
Atlanta.....	10-28-1955	Muncie.....	11-23-1954	Grenada.....	11-15-1955
Augusta-Richmond County.....	7- 2-1955	New Castle.....	11.....1954	Houston.....	6- 1-1955
Rainbridge.....	1-19-1956	Peru.....	2.....1955	Iuka.....	7-19-1955
Cairo.....	2-25-1955	Shelbyville.....	9.....1954	Kosciusko.....	8-10-1955
Calhoun.....	7-28-1955	South Bend.....	5- 2-1956	Meadville.....	10-13-1954
Camilla.....	9- 9-1955	Terre Haute.....	2- 3-1955	New Albany.....	1-18-1956
Columbus.....	2-17-1955	Vincennes.....	3- 7-1955	Oxford.....	12-14-1955
Dalton, Whitfield County.....	9- 9-1955	<i>Iowa</i>		Picayune.....	11- 4-1955
Dublin.....	3-18-1955	Dubuque.....	12- 2-1954	Starkville.....	3-26-1956
La Grange.....	12-16-1955	<i>Kentucky</i>		Vicksburg.....	7-10-1954
Moultrie.....	11- 4-1955	Bardstown.....	3.....1955	West Point.....	5-26-1955
Quitman.....	8-25-1955	Bowling Green.....	11-17-1955	<i>Missouri</i>	
Savannah, Chatham County.....	8-12-1954	Brandenburg.....	8-12-1954	Cape Girardeau.....	8-11-1954
Statesboro.....	12- 3-1954	Campbellsville.....	4- 8-1955	Kansas City.....	9-13-1954
Valdosta.....	4-18-1956	Frankfort.....	7-23-1955	St. Joseph.....	6- 9-1955
<i>Idaho</i>		Fulton.....	12-23-1955	St. Louis.....	11-28-1955
Jerome.....	11-24-1954	Georgetown.....	10-16-1954	Springfield.....	11-25-1954
<i>Illinois</i>		Hopkinsville.....	11-17-1955	<i>Nevada</i>	
Chicago.....	6-28-1955	Leitchfield.....	11-24-1954	Ely, McGill, and Ruth..	4-19-1955
<i>Indiana</i>		Louisville and Jefferson County.....	4-19-1956	<i>North Carolina</i>	
Anderson.....	6- 9-1955	Mayfield.....	9-16-1955	Beaufort County.....	3-31-1955
Bedford.....	8-30-1954	Monticello.....	7-13-1954	Bertie County.....	3-31-1955
Brazil.....	12-21-1955	Morgantown.....	6- 5-1956	Bladen County.....	6- 6-1955
		Murray.....	3-16-1956		



Communities awarded milk sanitation ratings of 90 percent or more, July 1954-June 1956—Con.

100 PERCENT OF MARKET MILK PASTEURIZED

Community	Date of rating	Community	Date of rating	Community	Date of rating
<i>North Carolina—Continued</i>		<i>Tennessee—Continued</i>		<i>Texas—Continued</i>	
Chatham County-----	4- 5-1955	Kingsport-----	11- 9-1955	Tyler-----	10-22-1954
Craven County-----	1-20-1956	Knoxville-----	8-26-1955	Vernon-----	10-26-1955
Cumberland County----	3-16-1956	Lebanon-----	8-27-1954	Victoria-----	11-24-1954
Durham County-----	7-27-1954	Manchester-----	10-21-1954	Wichita Falls-----	1-10-1956
Forsyth County-----	1-31-1955	Maryville-Alcoa-----	11-23-1954		
Halifax County-----	2-16-1956	Memphis-----	6-29-1955	<i>Utah</i>	
Iredell County-----	11-17-1954	Murfreesboro-----	7-14-1955	Ogden-----	10-18-1955
Lee County-----	4- 8-1955	Nashville and Davidson		Salt Lake City-----	2-10-1956
Lenoir County-----	1- 7-1955	County-----	10-27-1955		
New Hanover County--	5-24-1956	Newbern-----	10-28-1954	<i>Virginia</i>	
Onslow County-----	5-16-1955	Newport-----	10- 5-1954	Bristol-----	11- 3-1955
Orange County-----	4- 5-1955	Pulaski-----	9- 1-1955	Buena Vista-----	10-28-1955
Pender County-----	5-16-1955	Rogersville-----	11- 7-1955	Front Royal-----	11-10-1955
Person County-----	4- 5-1955	Springfield-----	7-23-1955	Glasgow-----	10-28-1955
Pitt County-----	4-20-1955	Sweetwater-----	10- 7-1954	Lexington-----	10-28-1955
Tyrrell County-----	8- 5-1955	Winchester-----	10-21-1954	Luray-----	11-11-1955
Washington County----	8- 5-1955			Norfolk-----	6- 1-1955
Wilson County-----	10-18-1955			Richmond-----	4- 6-1955
		<i>Texas</i>		Roanoke-----	8-20-1955
<i>Oklahoma</i>		Beaumont-----	5-24-1955	South Boston-----	4-13-1955
Ardmore-----	4-13-1956	Brownfield-----	5- 6-1955	Suffolk-----	7- 1-1955
Bartlesville-----	3- 8-1955	Brownwood-----	7-16-1954	Williamsburg-----	10-25-1955
Guthrie-----	5-11-1955	Bryan-----	8-30-1954		
Mangum-----	10-27-1955	Burkburnett-----	8-16-1955	<i>Washington</i>	
Okmulgee-----	3-16-1955	Cleburne-----	3-13-1956	Spokane-----	9-16-1955
Seminole-----	10- 1-1954	Corpus Christi-----	7-26-1955	Whitman County-----	10-14-1955
Sulphur-----	2- 9-1956	Dallas-----	9-29-1954		
Tulsa-----	6-10-1955	Edinburg-----	11-21-1955	<i>Wisconsin</i>	
				Baraboo-----	10-18-1955
<i>South Dakota</i>		El Paso-----	10-25-1955	Beaver Dam-----	3-29-1955
Aberdeen-----	8-28-1954	Falfurrias-----	1-21-1955	Beloit-----	12-20-1955
Sioux Falls-----	10-26-1954	Galveston-----	7-24-1954	Burlington-----	12- 5-1955
Sisseton-----	8-26-1954	Harlingen-----	1-26-1955	Delavan-----	12- 5-1955
		Huntsville-----	12- 3-1954	Elkhorn-----	12- 5-1955
<i>Tennessee</i>		Jacksonville-----	6- 7-1956	Fontana-----	12- 5-1955
Athens-----	8-10-1954	Kerrville-----	8-13-1954	Fort Atkinson-----	12- 5-1955
Bristol-----	11- 3-1955	Kilgore-----	7-14-1954	Green Bay-----	10- 6-1955
Chattanooga-----	12- 3-1954	Lufkin-----	3- 3-1955	Janesville-----	11-23-1955
Clarksville-----	2-10-1955	Midland-----	1-21-1955	Kenosha-----	7-14-1955
Cleveland-----	10-13-1954	Mineral Wells-----	12-14-1954	La Crosse-----	1-14-1955
Cookeville-----	9-21-1955	Nacogdoches-----	9- 3-1954	Lake Geneva-----	12- 5-1955
Covington-----	11-12-1954	New Braunfels-----	9- 2-1954	Madison-----	11-18-1955
Cowan-----	10-21-1954	Odessa-----	1-21-1955	Manitowoc-----	5-11-1955
Decherd-----	10-21-1954	Orange-----	5-19-1955	Ripon-----	3-29-1955
Dyersburg-----	10-29-1954	San Antonio-----	2- 8-1955	Sheboygan-----	7- 7-1955
Elizabethton-----	2-23-1955	San Benito-----	1- 8-1955	Waupun-----	3-29-1955
Gatlinburg-----	10- 6-1954	Sweetwater-----	11-17-1954	Williams Bay-----	12- 5-1955
Johnson City-----	9-23-1954	Texarkana-----	3- 9-1956		

**Communities awarded milk sanitation ratings of 90 percent or more, July 1954-June 1956—Con.**  
**BOTH RAW AND PASTEURIZED MARKET MILK**

<i>Community and percent of milk pasteurized</i>	<i>Date of rating</i>	<i>Community and percent of milk pasteurized</i>	<i>Date of rating</i>	<i>Community and percent of milk pasteurized</i>	<i>Date of rating</i>
<i>Georgia</i>		<i>Montana</i>		<i>Texas</i>	
Carroll County, 97.5-----	3-24-1955	Missoula, 99-----	11- 5-1954	Amarillo, 99.3-----	4-11-1955
Cartersville, 97.7-----	1-26-1955			Brady, 94-----	8- 7-1954
Cedartown, 97.7-----	11-19-1954	<i>Oklahoma</i>		Brenham, 94-----	6-13-1956
Gainesville-Hall County, 92.1-----	5-20-1955	Altus, 94.2-----	5- 5-1955	Childress, 83.4-----	4-22-1955
Griffin, 98.2-----	9- 3-1954	Elk City, 99-----	4-30-1956	Fort Worth, 99.98-----	2-29-1956
Macon, 99.7-----	6-23-1955	Enid, 98-----	5- 5-1955	Gainesville, 95-----	12- 1-1954
Newnan, 95-----	5- 3-1956	Henryetta, 80.7-----	4-17-1956	Gladewater, 98.8-----	7-14-1954
Pelham, 94-----	9- 7-1955	Lawton, 99.2-----	12-20-1955	Longview, 99.6-----	7-14-1954
Thomaston, 91.5-----	5- 3-1956	McAlester, 79-----	6-29-1955	Lubbock, 99.4-----	6-14-1956
Washington, 99.7-----	11-18-1955	Muskogee, 97.6-----	12-15-1955	McAllen, 99.2-----	11-21-1955
Winder-Barrow County, 98.5-----	3-10-1955	Norman, 99-----	1-16-1956	Mercedes, 99-----	11-21-1955
		Oklahoma City, 97.9-----	11- 4-1955	Paris, 98-----	2- 2-1956
		Ponca City, 96.6-----	4-18-1956	San Angelo, 99.7-----	9- 1-1955
		Shawnee, 98.8-----	11-18-1955	Seminole, 93.9-----	5-11-1955
<i>Kentucky</i>				Waco, 99.76-----	3-10-1956
Henderson, 98.9-----	9-23-1954	<i>Oregon</i>			
Princeton, 96-----	5-19-1955	Portland, 99.4-----	7-30-1955	<i>Virginia</i>	
Somerset, 95-----	2- 7-1955			Charlottesville, 99.4-----	10-17-1955
		<i>Tennessee</i>		Lynchburg, 98.8-----	12-----1954
<i>Missouri</i>					
Joplin, 97.5-----	9- 8-1955	Harriman, 96.2-----	11- 7-1955	<i>Washington</i>	
Moberly, 94.2-----	3- 1-1955	Kingston, 87.1-----	11-21-1955	Tacoma, 99.7-----	7-16-1954
Poplar Bluff, 97.4-----	8-18-1955				

**NOTE:** In these communities the pasteurized market milk shows a 90-percent or more compliance with the grade A pasteurized milk requirements, and the raw market milk shows a 90-percent or more compli-

ance with the grade A raw milk requirements, of the milk ordinance suggested by the United States Public Health Service.

Note particularly the percentage of the milk pasteurized in the vari-

ous communities listed. This percentage is an important factor to consider in estimating the safety of a city's milk supply. All milk should be pasteurized, either commercially or at home, before it is consumed.



# Child Guidance Clinic Policy and Practices

**T**HIS REVIEW of the personal, physical, psychological, and social characteristics of patients seen in the Los Angeles Child Guidance Clinic attempts to ascertain whom the clinic served and to derive, as far as possible, some ideas of the problems most suitable for child guidance clinic services, the procedures of intake and of closing cases, and how worth while the work of the clinic seemed to be.

The 500 cases studied were divided into two groups: 450 successive cases for which full responsibility was taken by the clinic and 50 cases for which major responsibility was taken by some other agency. In the latter, known as cooperative cases, the major role of the clinic was that of consultant and, sometimes, provider of continued psychiatric treatment.

All evaluations of medico-psychiatric procedures were the responsibility of the psychiatrist, who had had a major administrative responsibility for overall policies of the clinic for many of the preceding years. The procedures of experienced social research were applied, and a rather large listing of problems by category was worked out.

Some of the more significant conclusions reached and further questions raised were:

1. About 12 percent of the cases were considered unequivocally successful and 47 percent, partially successful. Criteria applied were disappearance or diminution of symptoms, clarification of parent-child relationships, insight into problems by patient or responsible adults, and clarification of problems to agencies.

2. Sharp clarification of the basic orientation of the agency. Is it primarily medical or psychiatric or social casework? What evidence is there that the clinic team functioned to best advantage? The conclusion was that only about one-fifth of the cases clearly called for a team approach; the others seemed to warrant referral

to casework agencies, private psychologists, school clinics, or other facilities not involving the specialized expense and complexity of the child guidance clinic.

3. What should be the relationship of the child guidance clinic toward other agencies in the community? Integration into the work of a health and welfare agency? Or should it



Public Health

MONOGRAPH

No. 42

The accompanying summary covers the principal findings presented in Public Health Monograph No. 42, published concurrently with this issue of Public Health Reports. At the time of the study, the authors were with the Los Angeles Child Guidance Clinic, Los Angeles, Calif.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

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Anderson, Forrest N., and Dean, Helen C.: Some aspects of child guidance clinic intake policy and practices. Public Health Monograph No. 42 (Public Health Service Publication No. 485). 16 pages. U. S. Government Printing Office, Washington, D. C., 1956. Price 20 cents.

**Communities awarded milk sanitation ratings of 90 percent or more, July 1954-June 1956—Con.**  
**BOTH RAW AND PASTEURIZED MARKET MILK**

<i>Community and percent of milk pasteurized</i>	<i>Date of rating</i>	<i>Community and percent of milk pasteurized</i>	<i>Date of rating</i>	<i>Community and percent of milk pasteurized</i>	<i>Date of rating</i>
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Macon, 99.7-----	6-23-1955	Enid, 98-----	5- 5-1955	Gainesville, 95-----	12- 1-1954
Newnan, 95-----	5- 3-1956	Henryetta, 80.7-----	4-17-1956	Gladewater, 98.8-----	7-14-1954
Pelham, 94-----	9- 7-1955	Lawton, 99.2-----	12-20-1955	Longview, 99.6-----	7-14-1954
Thomaston, 91.5-----	5- 3-1956	McAlester, 79-----	6-29-1955	Lubbock, 99.4-----	6-14-1956
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Winder-Barrow County, 98.5 -----	3-10-1955	Norman, 99-----	1-16-1956	Mercedes, 99-----	11-21-1955
		Oklahoma City, 97.9-----	11- 4-1955	Paris, 98-----	2- 2-1956
		Ponca City, 96.6-----	4-18-1956	San Angelo, 99.7-----	9- 1-1955
		Shawnee, 98.8-----	11-18-1955	Seminole, 93.9-----	5-11-1955
<i>Kentucky</i>				Waco, 99.76-----	3-19-1956
Henderson, 98.9-----	9-23-1954	<i>Oregon</i>			
Princeton, 96-----	5-19-1955	Portland, 99.4-----	7-30-1955	<i>Virginia</i>	
Somerset, 95-----	2- 7-1955			Charlottesville, 99.4-----	10-17-1955
		<i>Tennessee</i>		Lynchburg, 98.8-----	12-----1954
<i>Missouri</i>					
Joplin, 97.5-----	9- 8-1955	Harriman, 96.2-----	11- 7-1955	<i>Washington</i>	
Moberly, 94.2-----	3- 1-1955	Kingston, 87.1-----	11-21-1955	Tacoma, 99.7-----	7-16-1954
Poplar Bluff, 97.4-----	8-18-1955				

NOTE: In these communities the pasteurized market milk shows a 90-percent or more compliance with the grade A pasteurized milk requirements, and the raw market milk shows a 90-percent or more compli-

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Note particularly the percentage of the milk pasteurized in the vari-

ous communities listed. This percentage is an important factor to consider in estimating the safety of a city's milk supply. All milk should be pasteurized, either commercially or at home, before it is consumed.



# Experimental Approach to DDT Toxicity

Many human health problems have been created with the introduction of chlorinated hydrocarbons as pesticides. Much interest has centered around food residues, since one common method of application of these insecticides has been deliberately to use their residue effect for pest control. Owing to previous experience with other types of insecticides having a residue effect, there is an extensive precedent for food sampling, chemical analysis, legislation, and field regulations. However, to do this intelligently, the magnitude of the problem has to be carefully defined.

Specifically, in regard to chlorinated hydrocarbons there is no argument that these compounds are dangerous and lethal when ingested in large amounts. The only difference of opinion relates to the exact level at which a given food residue becomes sufficiently large so that its potential hazard to man outweighs its value for insect control. The development of insect resistance and tolerance is likely to make this type of decision increasingly difficult. DDT (2,2 bis-(p-chlorophenyl)-1,1,1-trichloroethane) is a typical example of a chlorinated hydrocarbon in extensive field use. This was the compound selected for experimentation.

In view of the importance of safeguarding human life, while permitting agriculture to use these chemicals as indicated, it would appear that there is a need for more basic information on the physiological effect of human exposure to low doses of these compounds. One approach is to simulate the human experience by continuously feeding various levels of DDT incorporated into the diet of white rats. This method, even though representing a laboratory simplification of field conditions, creates new difficulties in the evaluation of the significance of tissue changes or biochemical abnormalities.

Ultimately, the extrapolation of animal studies to human medicine represents the most vexing problem of all.



Public Health

MONOGRAPH

No. 43

The accompanying summary covers the principal findings presented in Public Health Monograph No. 43, published concurrently with this issue of Public Health Reports. The senior author is with the National Cancer Institute, Public Health Service, Bethesda, Md.; and the junior authors are with the Technical Development Laboratories, Communicable Disease Center, Public Health Service, Savannah, Ga.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

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Ortega, Paul, Hayes, Wayland J., Jr., Durham, William F., and Mattson, Arnold: DDT in the diet of the rat. Public Health Monograph No. 43 (Public Health Service Publication No. 484). 27 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956. Price 30 cents.

remain somewhat isolated as a highly specialized technical service?

4. Who should refer cases to the clinic? Is it desirable to have parents apply directly for clinic service when only a very small number of cases can be served in a huge area? Or should referrals come through physicians or professional agencies in which some degree of preliminary screening has been done?

5. The question of the suitability of many cases for clinic service is raised since 31 percent of the cases were closed out for reasons which amounted to "against the advice of the clinic."

6. What evidence is there that cases referred on the basis of symptoms which fall into certain categories are more amenable to treatment than other cases? That is, are cases in which symptoms are concrete, specific items of undesirable behavior more treatable than those in which symptoms are described in terms of generalized abstractions or "cause"?

The study does not give any definitive answers but is believed to raise a number of significant questions, with sufficient data on many of them to provide a basis for further studies.

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## Confirm Efficacy of Salt and Soda Solution

Clinical tests have confirmed the earlier laboratory findings of three Public Health Service scientists, Dr. Sanford M. Rosenthal, Herbert Tabor, and R. Carl Millican, that oral consumption of salt and soda solution in large amounts is an effective emergency treatment for shock due to burns.

The tests were conducted in Lima, Peru, by Peruvian and American scientists, headed by Dr. Kehl Markley, under the sponsorship of the Public Health Service. Reporting in the *Journal of the American Medical Association*, August 11, 1956, they said no toxic effects from the use of the saline solution, even though it was administered in large amounts, were observed in any of the 193 severely burned patients.

A simple, effective procedure for treatment of shock, which so often kills victims of severe burns during the first 48 hours after injury, is particularly valuable in a major disaster. As the saline solution may be prepared easily of materials available in almost every home (table salt, baking soda, and tap water) the method may save many lives in disasters when skilled medical care is not promptly available.

Shock formerly caused countless deaths among victims of burns and other types of injury. During the past 20 years, intravenous injection of whole blood, plasma, or the so-called plasma extenders has proved effective

in preventing such effects of shock. The difficulties of intravenous therapy, however, are considerable, and they are overwhelming in a major disaster.

Even today, a high proportion of early deaths among victims of burns covering 10 percent or more of the body area is attributable to shock. The trauma induces a state of profound physical and mental depression, usually 3 to 5 hours following injury. Its chief features include the following: marked fall in blood pressure; feeble and rapid pulse; decreased respiration; a sudden and intense, although incomplete, suspension of vital body functions; and, sometimes, unconsciousness. The victim's skin is pale and clammy. In burns, loss of circulating body fluids sets up an immediate and pressing need for replacement.

The saline solution used during the clinical tests may be approximated, for emergency purposes, by dissolving a teaspoonful of table salt and one-half teaspoonful of baking soda in a quart of drinking water. The patient should be encouraged to drink as much as he can of this solution. Of course, liquids should not be given to persons who are unconscious or who cannot swallow. A victim of burns may require as much as 6 or 7 quarts or more during the first 12 hours following injury.

*If nerve gases, incidentally or accidentally, contaminate public water supplies, the choice of methods for detection and decontamination will be crucial. Satisfactory methods for Sarin and Tabun are assured.*

## Nerve Gas in Public Water

By JOSEPH EPSTEIN, M.S.

**W**ATER WORKS ENGINEERS, alert to the hazards of radiological, biological, and chemical warfare agents, must be concerned primarily, among the chemicals, with the nerve gases.

Many other chemical agents, because of intrinsically low toxicity if admitted orally, or because of rapid hydrolysis to relatively nontoxic products, are unlikely to appear in hazardous concentrations in a large volume of water. For example, consider hydrogen cyanide and cyanogen chloride, extremely toxic if inhaled. It would take 1 ton of either, uniformly dissolved in a 10-million-gallon reservoir, to reach a concentration of 25 p.p.m. This concentration in water is considered physiologically tolerable for the average man if consumed in normal quantities for a 1-week period (1).

More specifically, it would take 1.66 tons of either chemical to reach a 25 p.p.m. concentration in Baltimore's 16-million-gallon capacity Montebello Reservoir; 43,200 tons in Boston's 415-billion-gallon Quabbin Reservoir; 13,500 tons in New York City's 130-billion-gallon Ashokan Reservoir.

In reservoirs of less than 1-million-gallon capacity, the margin of safety owing to dilution is, of course, reduced.

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*Mr. Epstein is chief, Sanitary Chemistry Branch, Biochemical Research Division, Chemical Warfare Laboratories, Army Chemical Center, Md.*

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Even the highly toxic and vesicant lewisite, when viewed in this light, presents little hazard as a water contaminant. Lewisite hydrolyzes almost instantaneously in water to the mildly vesicant oxide. The toxicity of the oxide is apparently due to its trivalent arsenic content, which may be oxidized with ease by chlorine or other oxidizing agents to the less toxic pentavalent state. In fact, trivalent arsenic becomes converted to the pentavalent state upon standing in water.

If water containing lewisite is chlorinated according to standard procedures for bacterial purification and is used for not more than 1 week to avoid possible cumulative effects, as much as 20 p.p.m. of lewisite can be tolerated in drinking water (1). Calculation of the quantities of lewisite required to produce concentrations of physiological significance in the bodies of water mentioned previously quickly reveal the improbability that significant contamination of large bodies of water by lewisite will occur as a result of general chemical warfare.

By similar reasoning, the danger of contamination of fairly large bodies of water during general warfare by agents such as phosgene, chloropicrin, chlorine, chloroacetophenone, diphenyl-chlorarsine, and the like is not particularly great.

Although it may appear that the danger of contamination of water supplies by most chemical agents will be small, nevertheless, the possibility of contamination to dangerous levels is a contingency which requires knowledge of the

Briefly, our experiments used 178 male and 104 female white rats fed levels of DDT from less than 0.05 parts per million of the poison in the diet as a whole up to 5,000 p.p.m. from periods of 2 weeks to 20 months. The animals were studied for clinical manifestations of toxicity, for gross and microscopic tissue changes, for rapidity of development and permanence of histopathology, and for recovery on a DDT-free diet after previous exposures. Special biochemical tests were used for body fat and tissue storage of DDT, as well as for liver function determinations. Certain laboratory devices

such as serial liver biopsy and study of different chemical isomers of this molecule added some supplementary information.

To summarize the results of the experiment, the salient feature among numerous other data was that cellular alterations could be demonstrated in the liver of rats fed DDT at levels as low as 5 p.p.m. in the diet. However, the findings indicated that stress should be placed on the mildness of these changes, their ready reversibility, and their imperfect correlation with liver function or with the clinical symptomatology of DDT.

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## technical publications

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### Infectious Hepatitis in New Delhi

Report of the Committee Investigating the Epidemic of Jaundice, December 1955-January 1956

*Public Health Service Reprint from the Hindustani Standard, February 18, 1956. 28 pages. Mimeographed.*

The text of a report by the committee which investigated the recent outbreak of infectious hepatitis in New Delhi, India, has been reproduced and is available in limited quantities from the Water Supply and Water Pollution Program, Robert A. Taft Sanitary Engineering Center, Cincinnati 26, Ohio, Attention: Dr. R. L. Woodward.

The report documents the first waterborne infectious hepatitis outbreak associated with a water supply treated in a modern water treatment plant providing coagulation,

rapid sand filtration, and chlorination. Bacteriological tests for coliform bacteria showed no evidence of contamination.

The report holds that the authorities concerned had taken the necessary steps to guard against bacterial contamination of the water but not against viral infection.

### Design for Statewide Nursing Surveys

*Public Health Service Publication No. 460. 88 pages. 50 cents.*

The latest techniques for finding the extent of nurse shortages and removing some of the causes are contained in a new manual prepared by the Division of Nursing Resources. Design for Statewide Nursing Surveys tells how to organize a survey committee, how to obtain community support for making surveys, and how

to gather and analyze information on local supply and nurse shortages.

A section on reappraisal of nursing needs and resources tells how to set up a plan for periodic fact finding after the basic survey has been made. Examples of progress in some 40 States which have made preliminary surveys, samples of the letters, forms, and tables used for compiling the facts, and suggested guides for evaluating adequacy of nurse supply are given.

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This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

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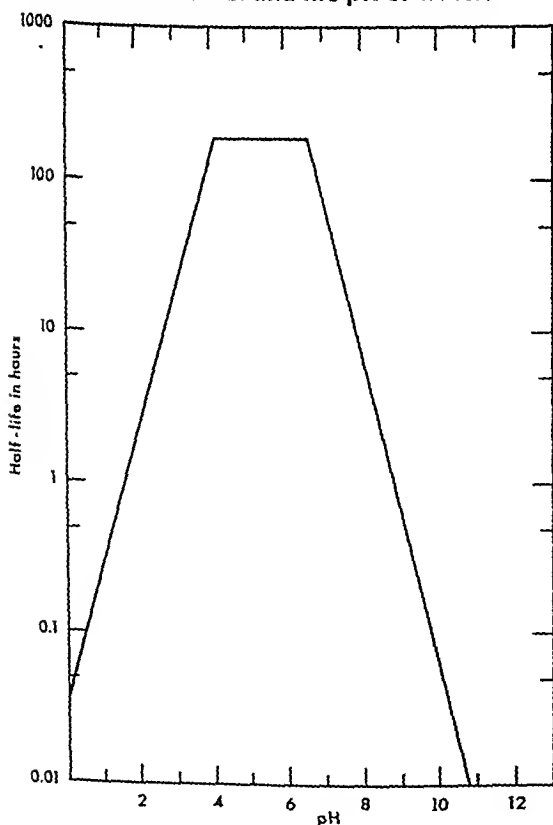


In the absence of large quantities of salts, the half-life ( $t_{1/2}$ ) of Sarin in water at 25° C. (77° F.) at constant pH in the pH range of 6.5 to 13.0 can be estimated from equation 2.

$$t_{1/2} = (5.4 \times 10^3) (10^{\text{pH}}) \quad [2]$$

Thus at pH 7, the half-life of Sarin in water at 77° F. is 54 hours; at pH 8, 5.4 hours; at pH 9, 0.54 hours, and so forth. Between pH 4.0 and 6.5, the hydrolysis rate of Sarin is at a minimum; its half-life in this range is approximately 175 hours. It is evident from equation 2 that above pH 6.5 the rate of hydrolysis increases 10 times per unit increase in pH. Below pH 4.0, the rate increases approximately 10 times per unit decrease in pH. At a given pH, the hydrolysis rate will vary by a factor of approximately 2 for each change of 10° C. The relationship between the half-life of Sarin in dilute aqueous solution at 25° C. and the pH of the water is shown graphically in figure 1.

Figure 1. The relationship between the half-life of Sarin at 25° C. and the pH of water.



The rates of hydrolysis which one might estimate from the use of equation 2 presupposes that the pH will remain constant during the time the Sarin is undergoing hydrolysis. For small concentrations of Sarin, that is, up to 5 p.p.m., in waters containing some buffer capacity, a constant pH will, in all probability, prevail. However, in the absence of significant buffer constituents in the water and at the higher concentrations of Sarin under discussion, the effect of the acidity produced by the hydrolysis may be very important to the stability of Sarin in water. In slightly alkaline water of low buffer capacity, the production of acids caused by a limited hydrolysis of Sarin can lower the pH to the range in which Sarin exhibits maximum stability. Thus, under certain conditions, the hydrolysis of Sarin may produce materials which retard subsequent hydrolysis. In effect, Sarin can stabilize itself.

The rate of hydrolysis of Sarin is accelerated by anions other than hydroxyl ions. The hydrolysis of Sarin is more rapid in the presence of such anions as trivalent phosphate or carbonate ions than might be predicted from the pH of the solution. On the other hand, the hydrolysis rate in the presence of rather large quantities of sulfate, chloride, or nitrate does not materially differ from the rate in water devoid of salts at the same pH. However, the quantities of the catalytic anions, for example, trivalent phosphate, needed to produce appreciable effects upon the hydrolysis rate, will not normally be encountered in water supplies.

Depending upon the pH of the water, some metal ions have strong catalytic effects upon the rate of hydrolysis of Sarin. Cupric, manganous, magnesium and calcium ions, to mention a few, are very effective catalysts, whereas sodium and potassium ions are virtually ineffective. Cupric and manganous salts are more effective in neutral or slightly acidic waters, whereas magnesium and calcium are more effective in alkaline waters.

At pH 6.5 and 25° C., where magnesium salts show practically no effect upon the hydrolysis rate of Sarin, the half-life of Sarin in water containing only 1 p.p.m. cupric ion is 2 hours as compared to a half-life of approximately 175 hours in the absence of the metallic ion. At pH 8.5 and 25° C., on the other hand, where

behavior of chemical agents in water and of methods of water purification or removal of the agents from water.

Quantitative data applicable particularly to the treatment of water contaminated with all but the more recent nerve gases are available (2,3). For a general history of the nerve gases and information relative to the mechanism of action, effects, and treatment of nerve gas poisoning, the reader is referred to articles by Holmstedt (4), Krop and Kunkel (5), Grob and Harvey (6), Wood (7), and Krop and Loomis (8).

In discussing the properties and behavior of the nerve gases Tabun and Sarin in dilute aqueous solution, the concentrations will be of the order of  $1-2-10^{-4}$  M or about 15-30 p.p.m., unless otherwise noted. The structures and chemical and common names of Tabun and Sarin as well as DFP, an agent similar to Sarin, are shown below.

#### Toxic Levels of Nerve Gases in Water

The level of tolerance to Sarin in water has been set at 0.5 p.p.m. with the limitation that the total volume of water taken per day will be no greater than 5 liters and that the period of ingestion will be no more than 3 days (7). This sets 2.5 mg. of Sarin as the maximum intake in a 24-hour period, and 7.5 mg. the maximum in a 3-day period. Except for the unlikely case of recontamination, the concentration on the second and third day will probably be somewhat lower than the initial concentration of 0.5 p.p.m., due to the natural and spontaneous hydrolysis of the nerve gas. The products of

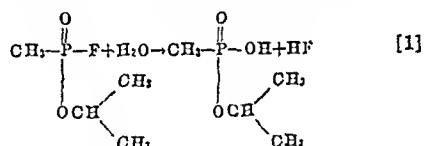
hydrolysis, from experimentation with rats, can be considered nontoxic.

By comparison of the toxicities to rats, it is estimated that Tabun is about one-fourth as toxic as Sarin via the oral route. A reduction of the "tolerance level" by 10 to 100 times may be advisable when infants or small children are to be the consumers. The quantities of nerve gases, then, which are needed to bring the level of contamination to a tolerance level for reservoirs of medium capacity do not appear to be of a magnitude sufficient to make contamination improbable.

In fact, it must be concluded that it is probable that water will become contaminated to hazardous levels if the nerve gases Sarin and Tabun are employed during warfare.

#### Hydrolysis of Sarin

Qualitatively, the behavior of Sarin in water is very similar to that of DFP whose hydrolysis in dilute aqueous solution has been thoroughly investigated (9). Like DFP, Sarin hydrolyzes to form two acids (equation 1), and the hydrolysis is catalyzed by both acids and bases, although bases are more effective catalysts.



The rate of hydrolysis is dependent not only upon the pH but also upon the type and quantity of dissolved solids in the water and the temperature of the water.

Common Name	Chemical Name	Structure
Tabun.....	Dimethylamido ethyl phosphorocyanidate.....	$\begin{array}{c} \text{O} \\ \parallel \\ (\text{CH}_3)_2\text{N}-\text{P}-\text{CN} \\   \\ \text{O C}_2\text{H}_5 \end{array}$
Sarin.....	Isopropyl methylphosphonofluoridate.....	$\begin{array}{c} \text{CH}_3 \\   \\ \text{HC}-\text{O}-\text{P}-\text{F} \\   \qquad \qquad   \\ \text{CH}_3 \qquad \qquad \text{CH}_3 \end{array}$
DFP.....	Diisopropyl phosphorofluoridate.....	$\begin{array}{c} \text{CH}_3 \\   \\ \text{HC}-\text{O}-\text{P}-\text{F} \\   \qquad \qquad   \\ \text{CH}_3 \qquad \qquad \text{OCH}(\text{CH}_3)_2 \end{array}$

may serve to warn that contamination has occurred. An abnormally high fluoride ion concentration in water should arouse the suspicion of the operator as to the potability of the water. However, since only 13 percent of the Sarin molecule after complete decomposition is fluoride ion, probably only when relatively high concentrations are in the water supply would the water be suspected because of fluoride ion concentrations.

The existence of fluoride ion and the low pH can only serve to point out that undecomposed Sarin may be present, not that it is. The same limitations apply to detection methods via the phosphorus moiety of the molecule.

It appears reasonable to conclude that dangerous concentrations of Sarin may remain undetected if only the nonspecific pH and chlorine demand tests and the tests for the fluoride ion and phosphorus are used. However, judicious choice of methods for estimation of fluoride ion concentrations and correlation of these tests with others such as pH and the alteration of the pH of the water observed at various time intervals may be helpful in the detection and estimation of Sarin.

Depending upon the method used for estimation of fluoride ion, one may obtain varying values for fluoride ion in waters containing both unhydrolyzed and hydrolyzed Sarin. If the methods recommended for fluoride in Standard Methods for the Examination of Water and Sewage, Ninth Edition, 1946, are used, then the total fluorine of the hydrolyzed and unhydrolyzed Sarin will be determined, since under the conditions of acidity required for this test, the bound fluorine in Sarin will be converted to ionic fluorine in a few minutes and thus will be determined as ionic fluorine. On the other hand, if fluoride ion is determined in neutral solution, and in the absence of hydrolytic catalysts, then only the fluoride ion present at the time of the test will be determined.

Both Sarin and Tabun in the presence of their hydrolysis products may be detected and estimated rapidly and in very low concentration by their reaction with benzidine or *o*-tolidine and alkaline peroxide solutions (12). By means of this reaction, the author and co-workers have been able to estimate quantitatively as little as 0.1 p.p.m. of Sarin in water, and the method

can probably be modified to increase the sensitivity.

The test has been adapted for field use and is included in two Chemical Corps water testing kits described in technical bulletins (13, 14).

The response of three small species of fish, the fathead minnow (*Pimephales promelas*), the green sunfish (*Lepomis cyanella*), and the goldfish (*Carassius auratus*) to Sarin and Tabun are useful to the detection and, in some cases, estimation of small concentrations of nerve gases in water. The approximate LC<sub>50</sub> (concentration of agent required to kill 50 percent of the test animals) for exposures of 10, 15, and 20 minutes at 70°-75° F. for the three species are shown in table 1.

It is possible to decrease the concentration of the nerve gas necessary to produce an LC<sub>50</sub> by increasing the exposure time, but with increased exposure times, the effect of the pH of the water becomes very important due to hydrolysis rates of the agents. Thus, for a 24-hour period, the LC<sub>50</sub> of Sarin for the sunfish is 2 p.p.b. (.002 p.p.m.) if the water is kept at pH 6.5 (minimum hydrolysis), but 9.5 p.p.b. at pH 8.0. Similar data have been obtained with the other species for Sarin and Tabun.

The LC<sub>50</sub> values are increased if the temperature of the water is lowered. For a change of approximately 25° F., the LC<sub>50</sub> values for a 10-minute exposure should be multiplied by 6 to 8 for the three species.

Table 1. Approximate LC<sub>50</sub> of Sarin and Tabun (p.p.m.) for fish at 70°-75° F., by various exposure times

Fish species	Tabun			Sarin		
	Minutes of exposure			Minutes of exposure		
	10	15	20	10	15	20
Green sunfish.....	1.5	1.0	0.70	0.35	0.23	0.27
Fathead minnow.....	1.5	.9	.60	.63	.40	.3
Goldfish.....	2.4	1.7	1.3	.93	.6	.5

## Decontamination

On the premise that decontamination procedures should reduce the level of Sarin and

the cupric ion is ineffective (due presumably to its insolubility) the half-life of Sarin may be decreased from 1.7 hours to 0.5 hours by the addition of 100 p.p.m. magnesium ion. The proportional effectiveness of magnesium ion is greater at alkalinities above pH 8.5, but is less necessary because of the effectiveness of hydroxyl ion alone at a higher pH.

Thus, in waters of high magnesium or calcium ion content, or in waters containing even trace quantities of some heavy metal ions, the hydrolysis rate of Sarin may be much more rapid than that predicted by equation 2. In most natural waters, however, the quantity and type of dissolved solids are such that prediction of the hydrolysis rate may be made from equation 2, provided, of course, that the pH is maintained constant during the hydrolysis.

### Hydrolysis of Tabun

The hydrolysis of Tabun, like that of Sarin and DFP, is catalyzed by acids and bases, and bases are more effective than acids (10). Unlike Sarin and DFP, whose products of hydrolysis are independent of the catalyst used, Tabun is destroyed by attacks upon different parts of the molecule by acid and base, and the products of hydrolysis are different. In alkaline solution, the phosphorus to cyanide linkage is cleaved, resulting in the formation of a substituted phosphonate and sodium cyanide. In acid solution, the Tabun molecule is cleaved between the phosphorus and nitrogen. Both attacks result in destruction of the toxic properties of Tabun. (See below.)

In alkaline solution, the formation of acid tends to lower the pH of the solution; in slightly acid medium, the hydrolysis products are one acid and one base, and the pH remains constant.

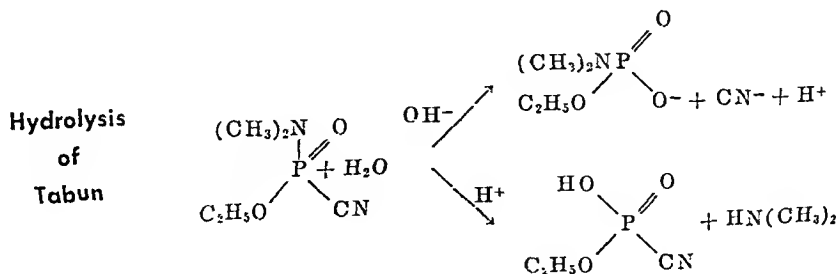
From the data of Larsson (10) and Holmstedt (11), it appears that the rate of hydrolysis of Tabun at the P—CN bond is for all practical purposes independent of the hydroxyl ion concentration between the pH range of 4.0 to approximately 8.5. The half-life of Tabun in this pH range at 20°–25° C. is 2–4 hours.

### Detection

Although a nerve gas attack would alert water works personnel, Sarin in water in concentrations of at least 35 p.p.m. is not detectable by odor or taste. Water containing concentrations of the hydrolysis products of Sarin as high as 200 p.p.m. was acceptable to rats. However, Tabun, which possesses a fruity odor, is detectable by smell in rather low concentrations. Furthermore, suspicion as to potability of water supply would be aroused by the odor of hydrocyanic acid which is formed by the hydrolysis of Tabun. Unlike Sarin, Tabun, through its released cyanide, will alter the "chlorine demand" of a water.

The uptake of chlorine in the reaction with Tabun will depend upon whether the chlorinating material is hypochlorite or chloramine. The chloramines will react only with cyanide ion which becomes available as a result of the hydrolysis of Tabun. The uptake of chlorine when hypochlorite is one of the reactants is also due to its reaction with cyanide, but apparently hypochlorite ion catalyzes the decomposition of Tabun to form cyanide so that, in effect, the uptake of chlorine is due to the Tabun as well as to the hydrolysis product.

If appreciable quantities of Sarin have hydrolyzed, and the contaminated water is of low buffer capacity, the low pH of the water, resulting from the acidic hydrolysis products,



Chlorine as hypochlorite will destroy Tabun, and the cyanide produced upon hydrolysis of Tabun will consume the chlorine.

Satisfactory procedures for decontamination of Sarin have been developed, utilizing the catalytic properties of hypochlorite. In field trials, HTH was used as the source of hypochlorite and, because rapid decontamination was desired, 100 p.p.m. chlorine was used. Following decomposition, the hypochlorite concentration was reduced to less than 1 p.p.m. by treatment with activated carbon.

Another satisfactory procedure for decontamination proved by field trials is to raise the pH of water to approximately 10.0 with soda ash, slaked lime or magnesium hydroxide, allow the Sarin or Tabun to hydrolyze, and when tests indicate that the concentration of the nerve gas is 0.1 p.p.m. or less, use a coagulant such as ammonium alum or ferric chloride, filter and

chlorinate. The rate of hydrolysis is followed by the test methods described (14) and the quantity of alkaline material to be added is regulated by the rate of hydrolysis. The alum or ferric chloride function not only as coagulants but also to reduce the pH of the water to normal acidities. Water treated by either procedure is potable and palatable.

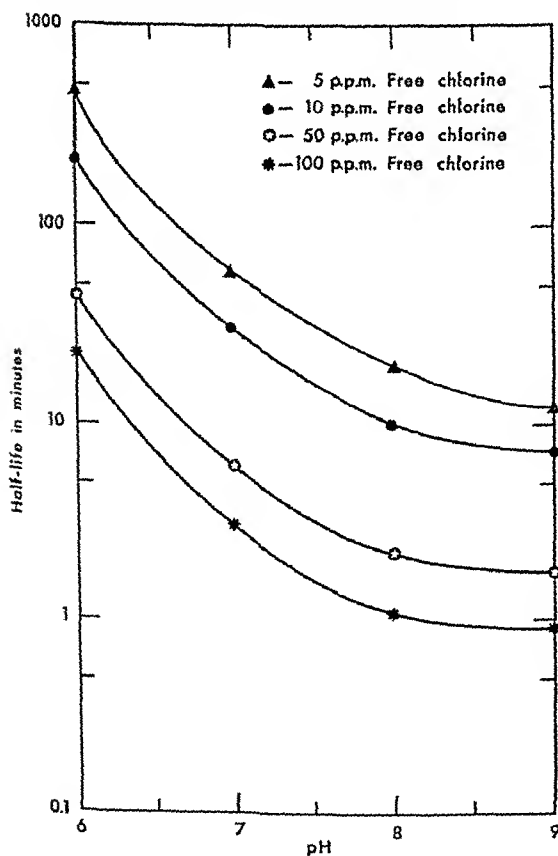
## Conclusion

From the preceding discussion, it appears reasonable to conclude that, in the event of general chemical warfare, the nerve gases Tabun and Sarin must be considered potential water contaminants because of the very small quantities of these agents required to produce toxic symptoms from ingestion. The hazard due to Tabun, however, is lessened somewhat because of its ease of detection in water by taste, odor, and chlorine demand test. Sarin presents a more difficult problem inasmuch as specific detection methods are necessary. Once detected, both Sarin and Tabun can be rapidly destroyed by simple decontamination procedures.

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Figure 2. The relationship between the half-life of Sarin at 25° C. and the pH of water for different concentrations of free chlorine.



Tabun concentration to 0.1 p.p.m., field tests have shown that coagulation with ammonium alum, followed by filtration through diatomite or sand filters is not an effective decontaminating procedure. A procedure involving the use of ferric chloride as coagulant and powdered limestone as coagulant aid, followed by filtration through diatomite filters is also ineffective. These materials are used in the Corps of Engineers Mobile Water Purification Unit (15).

Approximately 62 pounds of carbon would have to be added to each 1,000 gallons of water to reduce the concentration of 30 p.p.m. to 0.1 p.p.m. A smaller total dose of carbon can accomplish the same objective if a multiple treatment procedure is applied. However, the time involved and the multiplicity of operations make such a procedure objectionable.

Sarin in water is rapidly hydrolyzed by the catalytic action of strongly basic ion exchange resins, such as Amberlite IRA-400 and Nalcite SAR and strongly acidic cationic resins such as Dowex 50 and Amberlite IR-112. The anionic resins are more effective, and function not only as catalysts, but also remove the hydrolytic products. In doing so, however, the resins lose their available hydroxyl ion and ultimately their ability to catalyze the hydrolysis.

Furthermore, in water of appreciable dissolved solid content, the anions of the salts replace the hydroxyl groups in the resin (and cations, the hydrogen ions of the cationic resins) resulting in a decreased efficiency of the resin, since the efficiency is related to the number of available hydroxyl or hydrogen ions in the resin. The use of resins for large scale water decontamination is not economically feasible.

At least two feasible methods for the destruction of Tabun and Sarin in water supplies are available. Both methods are based upon an acceleration of the normal hydrolysis rate. The methods involve chlorination or alkalization.

Chlorine will not react with Sarin, but hypochlorite ion is a very effective catalyst for the hydrolysis of both Sarin and Tabun. Compounds containing combined chlorine, such as chloramine T, on the other hand, exert practically no catalytic action. Table 2 shows the half-life of Sarin in water at approximately

Table 2. Half-life of Sarin ( $2 \times 10^{-4}M$ ) in water in the presence of free chlorine

Temperature	pH	p.p.m. $Cl_2$	Half-life in minutes
77° F. -----	6	200	11
	7	25	13
	8	9	12
	9	4	15
36°-37° F. -----	6	200	38
	7	100	12
	8	100	3
	9	50	4

77° F. and 35° F. at various pH's and in the presence of free chlorine, added as high test hypochlorite (HTH).

The importance of pH in this reaction is seen from the figures shown in table 2 on experiments at 77° F. Only one-eighth of the chlorine concentration was required at pH 7.0 as was required at pH 6.0 to give approximately the same rate of destruction. Approximately one-third the concentration of chlorine was required at pH 8.0 to produce the same effect at pH 7.0, and so forth. It can also be seen by comparing the half-lives of Sarin in the presence of equal concentration of chlorine and at the same pH but at two different temperatures, for example, pH 6, that the rate of destruction is approximately doubled for each rise of 10° C.

Where time of treatment can be extended to several hours, much lower concentrations can be used to produce effective decontamination. For example, by maintaining the water at pH 8.0, addition of 5 p.p.m. chlorine will reduce the concentration of Sarin from 30 to 0.1 p.p.m. in approximately 3 hours. Figure 2 shows half-life of Sarin at 25° C. at pH ranges between 6 and 9 in the presence of different concentrations of free chlorine.

A dosage of chlorine to be added to a water supply may be calculated from the values given in figure 2, a knowledge of the concentration of Sarin in the water, the temperature and pH of the water. The action of hypochlorite may be completely inhibited, however, if amines or ammonium salts are present in the water because of the very rapid reaction of hypochlorite with the nitrogen compounds to form chloramines (16) which are catalytically inactive.

# Present Status of Controlled Fluoridation in the United States

**C**ONTROLLED water fluoridation for the prevention of dental caries started in 1945 with study projects in three communities—Newburgh, N. Y., Grand Rapids, Mich., and Southbury Training School in Connecticut. The study projects were a natural outgrowth of earlier epidemiological research in cities where fluoride has been present naturally in the water supply, and which demonstrated the inverse relationship between fluoride-bearing water and dental caries experience.

Reports of lowered caries incidence in the study communities were published in 1950 (1-3). As a result of these and other studies, the fluoridation of water supplies was endorsed by national health organizations and the practice adopted by many communities.

Summarized is the present status of controlled water fluoridation in the United States. The summary data include the number of communities, water supply systems, and population served by fluoridated water; the date the procedure was instituted; ownership of the water plant, and authorization for fluoridation. These data are presented primarily as reference material.

From 1945, when controlled fluoridation was introduced, through May 2, 1956, 1,352 communities served by 727 water supply systems instituted fluoridation (table 1). Sixty-six com-

munities (5 percent of the total) served by 54 water supply systems discontinued fluoridation. Of these, 7 communities, each one its own water supplier, reinstituted the procedure.

By May 2, 1956, a net total of 1,293 communities with 26 million people were served by 680 water supply systems to which fluoride had been added.

The annual increment in the number of communities and water supply systems in which fluoridation was initiated, discontinued, and reinstituted and the population they serve is shown in table 2. The greatest increase in the initiation of fluoridation occurred during 1952. Subsequently, annual increments in number of communities, water supply systems, and population have been at a lower level.

Table 3 shows the number and percentage of communities in each of 11 population groups using fluoridated water at the end of 1955.

Of the 1,255 communities using controlled fluoridation at the end of 1955, nearly 30 percent are under 1,000 in population, or of size not specified. Most of the latter are quite small since no population figures were available from Bureau of the Census sources. A little more than 30 percent of communities using fluoridation range in size from 1,000 to 5,000 population. Another 30 percent are between 5,000 and 50,000 population. The remaining 6 percent are over 50,000 in size.

When these figures are compared with the total number of communities of given size, nearly 45 percent of the communities of 500,000 population or over are fluoridating their water supplies, and from 20 to 30 percent of the com-

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*Prepared by the Division of Dental Public Health,  
Bureau of State Services, Public Health Service,  
Department of Health, Education, and Welfare.*

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## The Mayo Memorial

Forming the heart of what is virtually a complete medical center on the University of Minnesota campus is the recently completed Mayo Memorial. The university's School of Public Health occupies 2½ floors of the new building's 14-story tower section.

The Mayo Memorial, which was dedicated on October 21, 1954, is the fulfillment of an idea begun more than a decade ago. In 1939, shortly after Doctors Charles H. and William J. Mayo had died, the Governor of Minnesota appointed a Mayo Memorial Commission to propose an appropriate monument. After considering many projects, the commission agreed that a center for teaching and research as a building of the University of Minnesota Medical Center would be the most fitting memorial. During their lifetime, the Mayo brothers had devoted much time, interest, and aid to the work of this institution.

A Committee of Founders started the project on its way. Funds were raised by legislative appropriation, public subscription, and grants from public and private agencies.

Construction was started in 1951 and completed in the early autumn of 1954.

The new building brings together the facilities of the School of Public Health formerly scattered in several university buildings. On the 11th floor are laboratories, offices, and classrooms for work in environmental sanitation and epidemiology. The 12th floor houses facilities for biostatistics, health education, and the course in hospital administration. The public health nursing unit, offices for the non-professional health and hygiene courses, and other offices are located on the 13th floor, which the school shares with the medical school administration. Conference and reading rooms are provided on each of the three floors used by the School of Public Health.

In addition to the tower section, the Mayo Memorial has three 6-story wings that connect with existing hospital and medical school buildings. The building has facilities for education, research, and service in connection with various departments of the medical school.



using central water supplies, were drinking water with an adjusted fluoride content.

During the last few years, the number of people drinking fluoridated water has increased by about 4 million persons a year.

There is every reason to believe that this rate of increase will not decline and may very well become greater. However, as of May 1956 only 6 percent of the towns and villages of under 10,000 population had fluoridation, even though

**Table 2. Annual incremental findings on the institution, discontinuance, and reinstitution of controlled fluoridation showing number of communities, water supply systems, and population served, January 1945-May 2, 1956**

Year	Fluoridation instituted whether or not discontinued			Fluoridation discontinued whether or not reinstituted			Fluoridation reinstated after discontinuance		
	Number of communities	Number of water supply systems	Population	Number of communities	Number of water supply systems	Population	Number of communities	Number of water supply systems	Population
Total.....	1, 352	727	27, 453, 633	66	54	1, 680, 455	7	7	138, 312
1945.....	6	3	231, 920						
1946.....	6	5	96, 547						
1947.....	4	3	126, 281						
1948.....	8	2	122, 935						
1949.....	21	16	407, 674						
1950.....	50	34	528, 080	1	1	16, 550			
1951.....	232	110	3, 367, 433	1	1	12, 900			
1952.....	390	187	8, 542, 866	4	4	114, 190			
1953.....	238	134	3, 380, 303	7	7	61, 305	2	2	109, 753
1954.....	195	105	5, 256, 079	22	20	1, 062, 866	2	2	16, 458
1955.....	160	107	3, 811, 695	26	16	333, 840	2	2	4, 469
1956 <sup>1</sup> .....	42	21	1, 581, 820	5	5	78, 804	1	1	7, 632

<sup>1</sup> Through May 2, 1956.

**Table 3. Total communities in the United States, by size group, compared with the proportion of each using controlled fluoridation, December 31, 1955**

Population size of community	Number of communities in urban and rural area <sup>1</sup>	Communities using controlled fluoridation	
		Number	Percent of all communities of same size
Total.....	18, 548	1, 255	6. 8
1,000,000 and over.....	5	1	20. 0
500,000-999,999.....	13	7	53. 8
250,000-499,999.....	23	6	26. 1
100,000-249,999.....	65	19	29. 2
50,000-99,999.....	126	37	29. 4
25,000-49,999.....	252	70	27. 8
10,000-24,999.....	778	162	20. 8
5,000-9,999.....	1, 176	163	13. 9
2,500-4,999.....	1, 846	200	10. 8
1,000-2,499.....	4, 296	226	5. 3
Under 1,000 and not specified.....	9, 968	364	3. 7

<sup>1</sup> SOURCE: Number of places in urban and rural territory, by size of place: 1950. Statistical Abstract of the United States, United States Bureau of the Census, 1955, table 15, p. 23.

**Table 1. Annual cumulative findings on the institution, discontinuance, and reinstitution of controlled fluoridation showing number of communities, water supply systems, and population served, January 1945-May 2, 1956**

Year	Fluoridation status at end of each year			Fluoridation instituted whether or not discontinued		
	Number of communities	Number of water supply systems	Population	Number of communities	Number of water supply systems	Population
1945.....	6	3	231,920	6	3	231,920
1946.....	12	8	328,467	12	8	328,467
1947.....	16	11	454,748	16	11	454,748
1948.....	24	13	577,683	24	13	577,683
1949.....	45	29	985,357	45	29	985,357
1950.....	94	62	1,496,887	95	63	1,513,437
1951.....	325	171	4,851,420	327	173	4,880,870
1952.....	711	354	13,280,096	717	360	13,423,736
1953.....	944	483	16,708,847	955	494	16,804,039
1954.....	1,119	570	20,918,518	1,150	599	22,060,118
1955.....	1,255	663	24,400,842	1,310	706	25,871,813
1956 <sup>1</sup> .....	1,293	680	25,911,490	1,352	727	27,453,633

Year	Fluoridation discontinued whether or not reinstituted			Fluoridation reinstituted after discontinuance		
	Number of communities	Number of water supply systems	Population	Number of communities	Number of water supply systems	Population
1945.....						
1946.....						
1947.....						
1948.....						
1949.....						
1950.....	1	1	16,550			
1951.....	2	2	29,450			
1952.....	6	6	143,640			
1953.....	13	13	204,945	2	2	109,753
1954.....	35	33	1,267,811	4	4	126,211
1955.....	61	49	1,601,651	6	6	130,680
1956 <sup>1</sup> .....	66	54	1,680,455	7	7	138,312

<sup>1</sup> Through May 2, 1956.

munities of 10,000 to 50,000 population. For communities of less than 10,000 population, the percentage of fluoridation ranges from 4 to 14 percent. The proportion of communities that have instituted controlled fluoridation increases almost directly with grouped community size.

Public or private ownership of water supply facilities and authorization by which fluoridation was instituted, by grouped size of community, are shown in table 4.

It is interesting to note that of the 1,255 places with fluoridation as of December 31, 1955, more than a thousand owned their own water plants, and in 160 places the plants were under private ownership. Of the privately

owned plants, 68 percent were in places of under 10,000 population. Distributed on the basis of size of towns, however, 17 percent of the places under 10,000 population and 9 percent of the towns over 10,000 had privately operated water plants.

Table 4 also shows that in almost all communities the problem of whether or not to fluoridate is decided by the governing body. In only 6 percent of the communities was the question of fluoridation decided by referendums.

This census shows that in May 1956, after more than 10 years of water fluoridation, approximately 26 million people in about 1,300 communities, or roughly 1 out of every 4 people

# Analysis of a Hospital Consultation Program

By HELEN M. WALLACE, M.D., MARGARET A. LOSTY, R.N., ROBERT S. SIFFERT, M.D.,  
JEROME S. TOBIS, M.D., and MIRIAM LENDING, M.D.

**A**PPRAISAL of the effectiveness of individual programs is one of the basic needs in public health administration. All too frequently programs are initiated without an accompanying plan for evaluation. Or they are perpetuated without critical review and analysis to determine whether the originally planned objectives are being achieved. While it is not always easy to stimulate the development of new programs, sometimes it may be equally difficult to discontinue or modify old programs that prove to be partially or totally ineffective; frequently the underlying reason is the lack of substantiating facts of an evaluative nature.

Evaluation of public health programs should provide answers to two basic questions: (a) Is the program making a significant contribution toward improving the health of the public served? (b) Is the program making good use of the tax funds expended for the purpose? It is logical that if the answers to both ques-

tions are affirmative an existing program should be continued. If the answers are negative, the program should be reviewed carefully and either modified significantly or discontinued.

Since 1952 the bureau for handicapped children of the New York City Department of Health has provided consultation to hospitals participating in the health department's program for orthopedically handicapped children. To assess the value of this hospital consultation program, we have examined the results thus far and are reporting the findings.

## Background Information

The New York City Department of Health now spends approximately \$2 million annually for the hospital and convalescent care and rehabilitation of children with many other types of handicaps besides orthopedic—congenital cardiac, orthodontic, plastic surgical, hearing, cleft palate, epilepsy, drug addiction, visual, and miscellaneous types. Within this broad diagnostic list, the orthopedic category remains one of the larger groups because it represents the original program for handicapped children in New York City. Some of the other categorical programs are only a few years old. The bureau staff has developed hospital consultation for most of these categorical groups.

Hospital consultation has been carried on for many years in the fields of epidemiology and maternal and newborn care and for a shorter time in the field of general hospital care (because of the Hill-Burton Act). But to our knowledge the hospital consultation program

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**Table 4. Ownership and authorization for fluoridation in places fluoridating as of December 31, 1955, by size of community**

Population size of community	Number of communities	Ownership			Authorization				
		Public	Private	Not specified	Governing body alone	Referendum	Utilities commission	Other	Not specified
Total.....	1, 255	1, 093	160	2	1, 061	62	56	53	23
1,000,000 and over.....	1	1			1				
500,000-999,999.....	7	7			6	1			
250,000-499,999.....	6	5	1		6				
100,000-249,999.....	19	18	1		16			2	1
50,000-99,999.....	37	31	6		33	1		2	1
25,000-49,999.....	70	63	6	1	60	2	2	3	3
10,000-24,999.....	162	151	11		138	12	5	5	2
5,000-9,999.....	163	141	22		146	4	1	8	4
2,500-4,999.....	200	177	23		168	5	6	14	7
1,000-2,499.....	226	197	28	1	197	3	10	12	4
Under 1,000.....	154	118	36		139	7	4	3	1
Not specified <sup>1</sup> .....	210	184	26		151	27	28	4	

<sup>1</sup> Presumably under 1,000. The names of the towns are known, but their populations are not reported.

some 45 percent of the cities of more than 500,000 population were using fluoridated water. In numerical terms, this means 10 cities of over 500,000 persons do not have fluoridation and some 16,000 communities of under 10,000 population are not using fluoridated water.

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Newburgh-Kingston caries fluorine study. *Am. J. Pub. Health*, 40: 716-727 (1950).

(2) Dean, H. T., Arnold, F. A., Jr., Jay, P., and Knutson, J. W.: Studies on mass control of dental caries through fluoridation of the public water supply. *Pub. Health Rep.* 65: 1403-1408, October 27, 1950.

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## Engineering Abstracts on Sale

*Public Health Engineering Abstracts*, published by the Public Health Service, is now on sale at the Government Printing Office. Subscriptions can be obtained by writing to the Superintendent of Documents, Washington 25, D. C. Prices are \$2 per year, domestic; \$2.50 per year, foreign; 20¢ per individual copy.

This publication reviews monthly more than 600 domestic and foreign technical publications. The annual index includes a cross-reference by subject, author, and publication.

Table 1. Recommendations regarding policies and procedures, 25 hospitals

Recommendation	Hospitals in which recommended		Hospitals applying recommendation	
	Number	Percent	Number	Percent
<i>Inpatient service only</i>				
Use team approach.....	24	96	7	29
Provide pediatric supervision.....	14	56	5	36
Liberalize visiting hours.....	14	56	5	36
Improve pediatric notes.....	10	40	3	30
Refer for vocational counseling.....	10	40	4	40
Improve physical therapy notes.....	9	36	3	33
Incorporate social service notes in patient's record.....	5	20	3	60
Improve occupational therapy notes.....	5	20	2	40
Total hospital-items (200).....	91	45	32	35
<i>Outpatient service only</i>				
Set up appointment system in orthopedic outpatient department.....	17	68	0	0
Establish children's orthopedic clinic.....	15	60	4	27
Set up conference in orthopedic outpatient department.....	14	56	4	29
Arrange for followup of broken appointments.....	10	40	3	30
Change cast at time of clinic visit.....	7	28	5	71
Total hospital-items (125).....	63	50	16	25
<i>Inpatient and outpatient services</i>				
Set up unit system of records.....	18	72	7	39
Referral to visiting nurse association.....	17	68	11	65
Total hospital-items (50).....	35	70	18	51
Grand total hospital-items (375).....	189	50	66	35

from failure to consider all his needs—social, psychological, and followup, as well as pediatric and therapeutic. Improvements in outpatient service only were recommended 63 times and carried out 16 times (25 percent). The most frequent recommendation, that of instituting an appointment system, was not applied in any hospital. Implementation was obtained in approximately one-third of the recommendations for (a) a separate children's orthopedic clinic; (b) an effective followup of children failing to keep clinic appointments; and (c) for developing clinic staff conferences. In seven hospitals it was recommended that, for the convenience of the child and his mother, cast changes, where indicated, be performed at the time of the clinic visit instead of requiring another clinic visit on another day; almost three-quarters of the hospitals adopted this procedure.

Two major recommendations applied to both the inpatient and outpatient services. One consisted of the referral of patients to the voluntary public health nursing agencies in the community for home followup, public health nursing supervision, and physical therapy. This recommendation was adopted in two-thirds of the instances. The other consisted of setting up a unit system of records in the hospital to provide continuity of recorded information in the hospital setting. This recommendation was carried out by 39 percent of the hospitals.

### Personnel

A total of 95 recommendations pertained to personnel caring for orthopedically handicapped children and were carried out in 37 instances, or 39 percent (table 2).

The frequency of personnel recommendations

for handicapped children in New York City is the first of its kind in the field of chronic disease in children.

The details of this program have been presented in another report (1), but briefly the hospital consultation program functions in the following manner:

1. An advisory committee recommends a set of standards.

2. A team of specialists surveys the institutional services in the particular fields concerned.

3. The team then transmits a letter of recommendations to the key personnel of the institution.

4. At a postsurvey conference, the specialists discuss the recommendations with the key members of the institutional staff.

5. The survey team conducts followup activities, depending on the needs and requests of the individual institutions.

In the bureau's consultation program in the orthopedic field, the services of 25 children's hospitals have been surveyed by a team composed of an orthopedic surgeon, a pediatrician, a physiatrist, a hospital nursing consultant, and a medical social worker. Letters of recommendation have been sent to the staffs of 24 hospitals, and postsurvey conferences have been held with the staffs of 22 hospitals. Of the 25 hospitals, 15 are large general hospitals; 5 are specialty hospitals devoted predominantly or exclusively to the care of the orthopedically handicapped; 4 are for chronic diseases and 1 for communicable diseases.

We have taken as the endpoint in this analysis the information collected at the postsurvey conferences.

### Survey Recommendations and Results

The survey data have been subdivided into four headings for presentation: (a) policies and procedures; (b) personnel; (c) accreditation; (d) physical plant and equipment. These four headings represent the great majority of all the recommendations made. To arrive at a simple summary of the survey data, a function "hospital-items" has been used. It is the product of the number of hospitals times the number of items evaluated, recommended, or adopted in any particular subgroup. Thus,

in the policies and procedures group, 25 hospitals were surveyed and 15 items evaluated, that is, 375 hospital-items. In all, 189 hospital-items were recommended under the policies and procedures heading (50 percent of the 375 hospital-items evaluated in this category); 95 pertained to personnel (38 percent); 13 to accreditation (17 percent); and 12 to physical plant and equipment (24 percent).

### *Policies and Procedures*

In the policies and procedures area a total of 91 recommendations pertained to inpatient service only, 63 recommendations to outpatient service only, and 35 recommendations to both services. Thirty-five percent of the recommendations were adopted by the hospitals (table 1).

For inpatient service, the recommendations of individual items varied in frequency from advising the team approach to patient care in 24 hospitals to advising improvement of social service and occupational therapy notes in 5 hospitals. Implementation of recommendations by the hospitals varied from 60 percent for improvement in social service records to 29 percent for developing a team approach to patient care. Changes were made most frequently as a result of the recommendations in the most specific, simplest, and superficial areas, such as recording of patient information. The least frequent implementation occurred in the conceptual area of patient care—the team approach, which signifies that the optimum care of the handicapped child requires the participation of many professional disciplines working together as a team.

Only about one-third of the hospitals in which the recommendations concerned the inpatient service improved their pediatric supervision of children and improved their pediatric notes. Also only one-third of the hospitals liberalized visiting hours for the parents of the children. Although this type of recommendation does not deal specifically with the orthopedic care of the child, its importance should not be minimized since the consideration of the "child" is as important as the consideration of the "patient." Too often the child leaves the hospital with a healed operative scar but with an unhealed scar resulting

**Table 3. Recommendations regarding accreditation, 25 hospitals**

Item	Hospitals in which recommended		Number of hospitals applying recommendation
	Number	Percent	
Approval by American Board of Orthopedic Surgery.....	6	24	<sup>1</sup> 0
Approval by American Board of Pediatrics.....	3	12	0
Pediatric residency on affiliated basis.....	4	16	<sup>2</sup> 0
Total hospital-items (75).....	13	17	0

<sup>1</sup> Efforts made by 2 hospitals, not yet successful.

<sup>2</sup> Efforts made by 1 hospital, not successful.

**Table 4. Recommendations regarding physical plant and equipment, 25 hospitals**

Item	Hospitals in which recommended		Hospitals applying recommendation	
	Number	Percent	Number	Percent
Improve outpatient department facilities.....	6	24	1	17
Improve inpatient facilities.....	6	24	3	50
Total hospital-items (50).....	12	24	4	33

consolidation of the physical location of the orthopedically handicapped children from six different places within the hospital into one central service; provision of a modern operating room, more adequate facilities for physical therapy, and a more suitable plaster room; and removal of an "isolation cubicle" from the children's ward. The recommendations for the outpatient service include: more space in general, more examining space, more space for physical therapy activities, and more privacy for patient examination and interpretation.

#### Discussion

The results of the first survey of the children's hospital orthopedic services, the transmission of postsurvey recommendations, and the postsurvey conferences may be summarized as follows:

The hospitals put into practice 35 percent of the hospital-items recommended in the area of policies and procedures, more frequently those pertaining to inpatient service than to outpatient service. They adopted 39 percent of the

hospital-items recommended in the area of personnel and 33 percent recommended for physical plant improvement. None of the recommendations for accreditation by the American Boards of Orthopedic Surgery and Pediatrics were fully implemented although several hospitals tried.

That this degree of implementation was achieved is gratifying, particularly so because of the apprehension some of the hospital staffs expressed initially about the project. This communitywide survey of the children's hospital orthopedic service was the first in the history of the health department's program. The hospitals may have been apprehensive about the possibility that the New York City Department of Health might withdraw approval, with resultant loss of prestige and funds for patient care and of patient referral.

It was the impression of the survey team, however, that many institutions were genuinely anxious to improve their services. By discussing recommendations frankly, bringing all the medical and nonmedical personnel concerned together, and acquainting them with the suc-

varied from the assignment of a pediatrician to the children's orthopedic clinic in 17 hospitals to the appointment of a qualified director of the anesthesia services in 4.

Where recommended, about 60 percent of the hospitals employed physical therapy staff and improved services for psychological testing of the children. About 50 percent improved the medical supervision of the hospital's department of physical medicine and rehabilitation and appointed a qualified director of the anesthesia service. About 40 percent appointed a qualified nurse in charge of the children's orthopedic service, provided 24-hour coverage of the service by a registered professional nurse, arranged for additional work experience in orthopedic nursing for the nursing staff, and employed an additional social worker for the children's orthopedic service. However, only one-fifth of the hospitals were able to develop a department of physical medicine and rehabilitation within the hospital or to assign a pediatrician to the children's orthopedic clinic.

#### *Accreditation*

Thirteen hospitals were counseled to seek accreditation by the American Board of Orthopedic Surgery or the American Board of Pediatrics or to seek a modified pediatric residency in affiliation with a hospital approved for this purpose within the community. None of these hospitals were able to fulfill any of these

recommendations, although 2 of the 6 hospitals tried to obtain approval for an orthopedic residency training program, and 1 hospital tried to obtain a pediatric resident on an affiliated basis (table 3).

No recommendations were made for residency approval in the specialty of physical medicine and rehabilitation because practically all of the hospitals with departments of physical medicine and rehabilitation are also approved for residency training in the specialty.

#### *Physical Plant and Equipment*

In 12 instances, improvements were recommended in the physical setup, divided equally between the inpatient and outpatient services (table 4). Three of the hospitals carried out the recommendation for the inpatient service and only one hospital for the outpatient service. In addition, during the survey period, two hospitals (one a large general hospital and the other a large specialty hospital) constructed entirely new buildings, and a third hospital (a large specialty hospital) undertook an extensive reconstruction program. In these three instances, the bureau staff participated in a review of proposed blueprints but could not be credited as being the instigating force for the change.

Illustrating the types of recommendations made for the inpatient service are: installation of running water in a large children's ward;

**Table 2. Recommendations for personnel, 25 hospitals**

Recommendation	Hospitals in which recommended		Hospitals applying recommendation	
	Number	Percent	Number	Percent
Assign pediatrician to children's orthopedic outpatient department.....	17	68	3	18
Provide 24-hour nursing coverage by registered nurses.....	16	64	7	41
Develop department of physical medicine and rehabilitation.....	10	40	2	20
Employ physical therapy staff.....	10	40	6	60
Appoint qualified charge nurse.....	9	36	4	44
Provide training in orthopedic nursing.....	8	32	3	38
Employ social worker.....	8	32	3	38
Improve psychological testing service.....	7	28	4	57
Improve medical supervision in physical medicine and rehabilitation.....	6	24	3	50
Appoint qualified director of anesthesia service.....	4	16	2	50
Total hospital-items (250).....	95	38	37	39



Here too, much greater success was achieved in the inpatient than in the outpatient services.

That hospital consultation for orthopedically handicapped children is productive and has achieved some degree of accomplishment, even in its early phases, is clear. The greatest areas in need of further interpretation and strengthening include outpatient care, pediatric care,

development of departments of physical medicine and rehabilitation, and the team concept.

#### REFERENCE

- (1) Wallace, H. M., Losty, M. A., and Siffert, R. S.: Principles in a hospital consultation service, *Am. J. Pub. Health* 44:1434-1441, November 1954.

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## NRC Medical Research Fellowships

Applications for 1957-58 postdoctoral research fellowships in the medical sciences and radiology are being accepted by the National Research Council until December 1, 1956.

Awarded and administered by the Medical Fellowship Board and the Committee on Radiology of the Division of Medical Sciences, the fellowships include the following groups: national research fellowships in the medical sciences, supported since 1922 by the Rockefeller Foundation; the Donner fellowships for medical research, made possible by a new grant from the Donner Foundation; Markle fellowships in the medical sciences, provided through a new appropriation of the John and Mary R. Markle Foundation; and fellowships in radiological research, administered for the James Picker Foundation.

The first three of these programs offer research in the basic medical sciences for persons seeking careers in academic medicine and investigation. Fellows devote essentially full time to research at the fundamental level. Funds are not available to those wanting to get practical experience in clinical fields.

These awards, open to United States and Canadian citizens holding doctorates in medicine or philosophy or the equivalent, are not ordinarily granted to persons over 35 years of age.

Candidates for the radiological research fellowships must hold the degree of M.D., Ph.D., or Sc.D., or the equivalent. Preference is given to those whose training has been in the field of radiology, but persons from closely related disciplines are eligible to apply. There are no limitations as to citizenship, and the age limit is the same as in the other awards.

The fellowships are awarded in the early spring. Complete details and application blanks may be obtained from: The Division of Medical Sciences, Room 310, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, NW., Washington 25, D. C.

cessful experiences of more efficient services, the team could help the chiefs of service and administrators plan and carry out important basic changes.

Intensive efforts of the survey team members, both as a group and individually, to interpret the purpose of the surveys dispelled some of the concern and apprehension, and the hospital staffs began to realize that the survey team's aim was constructive assistance. An important factor in success or failure of the survey technique and of hospital consultation in general is the interpersonal relationships established between the members of the hospital staffs and the members of the survey team. A friendly working relationship, professional respect, effective interpretation, sincerity, and technical knowledge are the essentials in determining success.

Frequently queried was the reason for the development of the hospital consultation program for handicapped children. The paying agency does have a responsibility in this field, both for helping to improve the care given the children and for guaranteeing to the taxpayer that the tax funds expended are being carefully and justifiably used.

The surveys disclosed several unexpected conditions: (a) An unevenness exists in the quality of care given the children by the group of hospitals; (b) children are being kept in the New York City hospitals longer than they need to be; and (c) more hospitals are approved for the care of orthopedically handicapped children in the New York City program than probably are needed.

Of these three findings, the hospital consultation program has been able to begin to cope with the first two, quality of care and overinstitutionalization. The excess of inpatient beds over the number of children requiring inpatient care is harder to solve. Most of these hospitals have been approved for participation in the orthopedic phase of the handicapped children's program for many years. Withdrawal of long-standing approval is usually difficult.

It is not surprising that more success was achieved in implementing the recommendations for the inpatient than for the outpatient services. In a large urban area the chief of the clinical service and his higher ranking staff usually do not participate personally in the realm of

outpatient care. This criticism of outpatient services is not only applicable to the institutions concerned, but it applies equally to the paying agency, which has supported inpatient care but has not yet accepted any financial responsibility for outpatient care. This is a curious policy since most orthopedically handicapped children in the lower income groups receive their medical care through the outpatient service, with only a small percent receiving inpatient care for briefer periods of time. Furthermore, the outpatient service has many roles to play in the care of orthopedically handicapped children—case finding, evaluation, and diagnosis; ongoing medical care and supervision; medical recommendations for special educational placement; and, theoretically at least, some responsibility for the care of the patient at home. Thus, if improvement in the care of orthopedically handicapped children is to progress significantly, outpatient care must be strengthened.

One of the expected findings was that hospital staffs are more immediately able to implement the simpler and more tangible recommendations, for example, improvement of patient records, than the broader and more complex recommendations such as the development of a team concept. While the term "team approach" has been used for many years, nevertheless, it is apparent that the concept has not yet been thoroughly understood in the care of the orthopedically handicapped child. Here, the value of a long-standing effective hospital consultation program can be truly demonstrated since continuing consultation and interpretation will be necessary to motivate the hospital staffs to develop their teams.

That no success was achieved immediately in the area of accreditation by the medical specialty boards is not surprising for several reasons: first, because it takes time for an institution to accomplish this objective, and, second, because there is the knotty problem of supply of approved residency training programs as opposed to the lesser demand for them quantitatively.

It was surprising that in such a brief period of time there was as much implementation of the recommended physical plant and personnel items, the two major areas in which the institution would have to spend the most funds.

acids have the ability to form soluble metal chelate compounds in which the polyvalent metal ion has been bound in a nonionic form. They are nonspecific; that is, they will inactivate practically any metallic ion with which they come in contact.

In a 1.0 percent solution, Versene Regular has a pH of 11.8. In order not to change materially the pH of the test waters, a  $10^{-1}$  stock solution was prepared by combining 1 part Versene Regular with 8 parts double distilled water and 1 part 1N HCl. The pH of this solution was approximately 6.5. The neutralized EDTA  $10^{-1}$  solution was sterilized by autoclaving for 15 minutes at  $121^{\circ}\text{C}$ .

The plating medium used was Bacto-tryptone glucose extract agar.

*Escherichia coli* ATCC 11229 was the inoculum used. All suspensions were prepared in buffered distilled water diluent (11) from cultures grown in nutrient broth for 24 hours at  $37^{\circ}\text{C}$ .

#### Effect of EDTA on *E. coli*

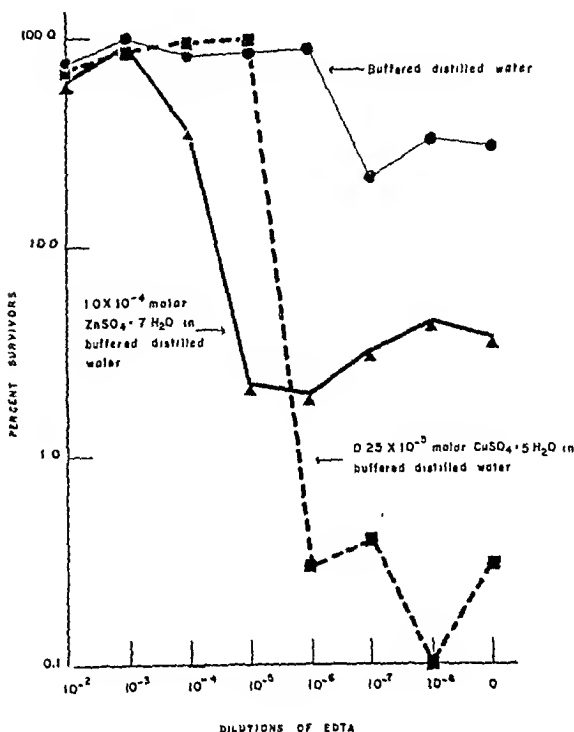
The first in the series of experiments was a study of the effect of the chelating agent on *E. coli*. For this study, varying log dilutions of EDTA in buffered distilled water were prepared. To each of these dilutions, tubed in 9.0-ml. aliquots, was added 1.0 ml. of a diluted cell suspension so that the test dilutions contained 200 to 300 cells per milliliter. These suspensions were kept at  $25^{\circ}\text{C}$ . for 2 hours and then plated to determine the viable cell count.

The light solid line in figure 1 shows the mean result of five trials. The  $10^{-3}$  to  $10^{-6}$  dilutions of EDTA gave a pronounced increase in recovery of cells over the recovery in cell suspensions containing no EDTA, that is, the buffered suspensions. This increase is indicative of an adverse effect of the buffer solution on *E. coli* under these conditions.

#### Chelation of Polyvalent Metals

The second in the series of experiments was a demonstration of the chelation of polyvalent metallic ions. Varying amounts of EDTA were combined with concentrations of metals known to be toxic to *E. coli* cells, and cells were then added to these chelated solutions.

Figure 1. Effect of EDTA on survival of *Escherichia coli* in several waters after 2 hours' exposure at  $25^{\circ}\text{C}$ .



Copper and zinc were the metals chosen for this demonstration. Stock solutions of 0.1 molar  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  and  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  were prepared using double distilled water. These were further diluted with sterile buffered distilled water so that the final concentrations were  $0.25 \times 10^{-5}$  molar for the copper solution and  $1.0 \times 10^{-4}$  molar for the zinc solution, which correspond to concentrations of 0.16 and 6.5 p.p.m., respectively. These solutions were tubed in 8.0-ml. aliquots. Log dilutions of EDTA from  $10^{-1}$  to  $10^{-7}$  were prepared separately, and 1.0-ml. portions were added serially to the copper and zinc solutions. *E. coli* cell suspensions were added to each of the copper and zinc solutions containing varying amounts of EDTA so that the final cell concentration was approximately 200 to 300 cells per milliliter. These suspensions were held at  $25^{\circ}\text{C}$ . for 2 hours and then assayed for viable cell count.

The dotted line in figure 1 shows the mean result of five trials with the copper solution. The optimum range for chelation of the copper

*The addition of a chelating agent to water samples examined for pollution may be one answer to the problem of maintaining the coliform index near the level existing when a sample is taken. For periods up to 24 hours, a chelating agent materially reduced the "death rate" of coliform bacteria.*

# Chelation as a Method for Maintaining the Coliform Index in Water Samples

By E. L. SHIPE, Jr., M.S., and ADELAIDE FIELDS, B.S.

THE POSSIBLE USE of a chemical chelating agent to preserve coliform bacteria in water samples examined for pollution has been explored in a series of experiments by the Tennessee Department of Public Health. Samples of various waters, inoculated with *Escherichia coli*, were tested to determine the rate of decrease in viable cells and the effect of a chelating agent on this rate of decrease.

The coliform bacteria are widely used as indicators of pollution in untreated waters, although at present this practice is a matter of some controversy. Evidence that coliform organisms multiply in waters containing organic matter has been reported by a number of workers, including Caldwell and Parr (1), Leahy (2), and Mallmann (3). However, there appears to be more evidence that the coliform index decreases rapidly during storage of samples, even during storage at low temperatures. Caldwell and Parr (4), Cox and Claiborne

(5), the British Public Health Laboratory Service Water Subcommittee (6), and Leininger and McCleskey (7) have reported a material decrease of coliforms in samples after storage at various temperatures and for various periods of time.

These reports dealt primarily with temperature and time as factors influencing the decrease in coliforms. It seems reasonable, however, that the presence of certain chemicals in the water might also be a factor. The toxicity of polyvalent metallic ions for *E. coli* has been demonstrated by several workers, including Hotchkiss (8) and Fabian and Winslow (9). Waters receiving certain industrial wastes may well contain concentrations of metals sufficient to reduce the number of bacteria. A chelating agent added to samples taken from such waters would bind, or complex, any metallic ions present and would thereby prevent their deleterious effect on the bacteria.

## Materials

The chelating agent used in the experiments was Versene Regular, the tetrasodium salt of ethylenediamine tetra acetic acid (EDTA). This compound is one of several powerful amino acids and their salts which are useful as complexing agents for metal ions (10). These

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Ten trials were performed for each water tested.

In figure 2 the loss of viable cells exposed to copper is shown by the heavy line. The circles indicate the viable cell count at the time of chelation with EDTA; the triangles, the count in the chelated suspension after a period of 2 hours' exposure; and the squares, the count after 24 hours' exposure.

In an unchelated sample, the cells in the suspension apparently die off shortly after 2 hours' exposure. In the 2-hour samples, the rate of cell count decrease was definitely changed by the addition of EDTA. As exposure to copper continued, the slope of the line increased from time of chelation to the 2-hour period. This indicates that as exposure continues progressive damage may be done to the cells which cannot be overcome by chelation. The slope from 2 hours to 24 hours was about the same for all of the time intervals.

Figure 3 shows similar data for the zinc solution. Chelation of zinc apparently holds the count at approximately the same level as it is at the time of chelation. From the 24-hour

Figure 4. Effect of EDTA on rate of decrease in *Escherichia coli* in buffered distilled water.

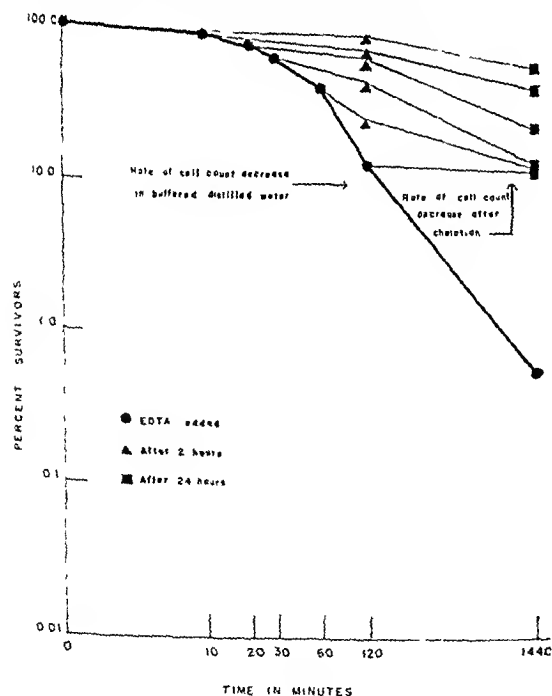
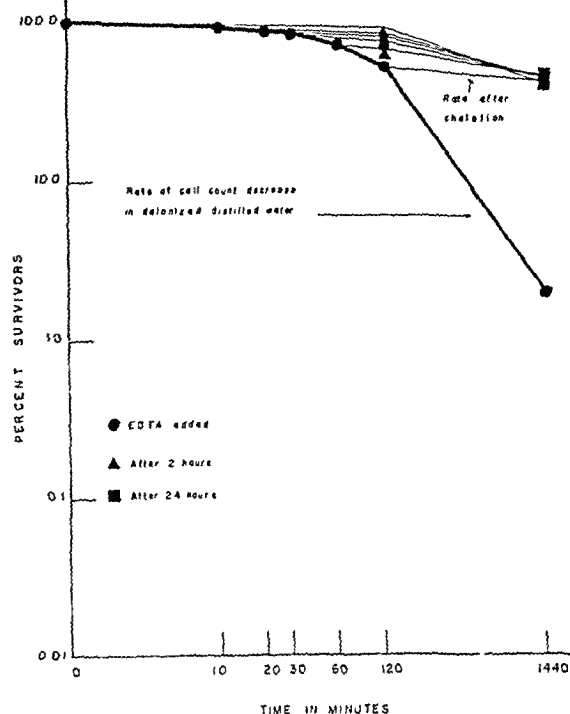


Figure 5. Effect of EDTA on rate of decrease in *Escherichia coli* in deionized distilled water.



samples, it can be surmised that some of the cells recover after standing in EDTA, or else the remaining cells are stimulated to multiply to a slight degree.

Figure 4 shows the results obtained when buffered distilled water was used as a suspending fluid. EDTA is apparently effective in reducing the rate of decrease in *E. coli* cells in buffered distilled water void of added metals.

In figure 5 are shown the data for the deionized water. This material had the lowest "bacterial death rate" of any of the waters tested. Even so, the addition of EDTA to deionized water resulted in an improved recovery, possibly because of an osmotic pressure difference more favorable to the cells than deionized water.

The mean pH of the waters tested was  $6.87 \pm 0.13$ .

## Discussion

These experiments have shown a rate of decrease in *E. coli* cells suspended in various waters. Waters containing small amounts of

solutions was  $10^{-3}$  to  $10^{-5}$  dilutions of EDTA. Above the  $10^{-5}$  dilution there was a decided decline in recovery of viable cells because of insufficient EDTA and a resultant copper toxicity.

The mean result of five trials with the zinc solution is shown by the heavy solid line in figure 1. The optimum dilution of EDTA for chelation of zinc appears to be  $10^{-3}$ . A gradual loss in cell recovery occurred as the dilution of EDTA increased.

### Effect on Bacterial Death Rates

If fecal pollution enters water containing sufficient quantities of polyvalent metals to result in toxicity to the coliforms, samples collected from this water may well be free of coliforms by the time they reach the laboratory for analysis, even in a matter of a few hours. The addition of EDTA to such samples might interrupt this "death rate" at the time the sample is taken. To investigate this possibility, the following series of laboratory trials was made.

Cell suspensions of *E. coli* containing 2,000 to 3,000 cells per milliliter were prepared. Enough  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  solution was added to

Figure 2. Effect of EDTA on rate of decrease in *Escherichia coli* in  $0.25 \times 10^{-5}$  molar (0.16 p.p.m.)  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  buffered distilled water.

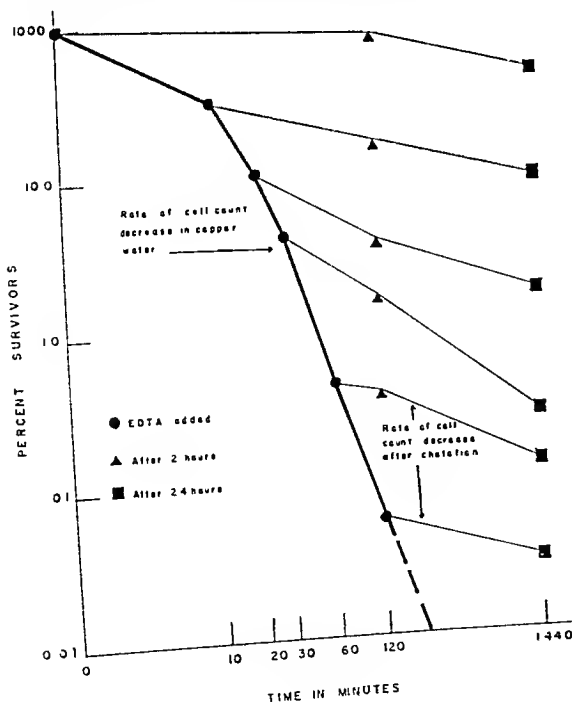
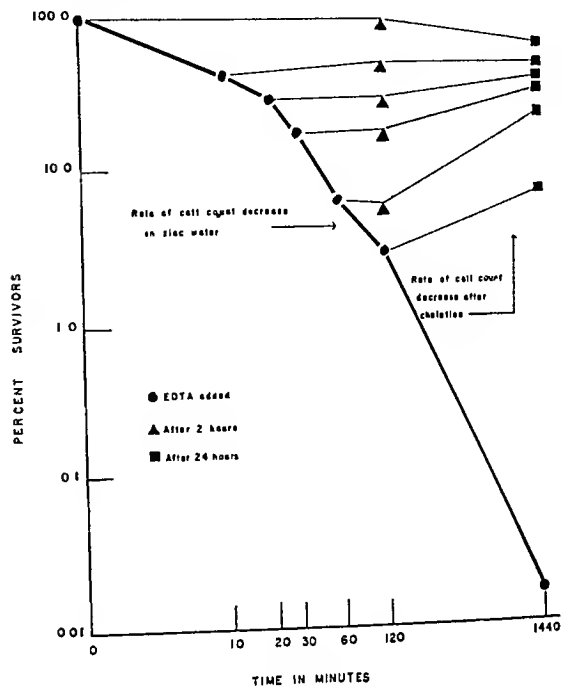


Figure 3. Effect of EDTA on rate of decrease in *Escherichia coli* in  $1.0 \times 10^{-4}$  molar (6.5 p.p.m.)  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  in buffered distilled water.



these suspensions to produce a  $0.25 \times 10^{-5}$  molar (0.16 p.p.m.) solution. Immediately after addition of the  $\text{CuSO}_4$ , 10.0 ml. of the suspension was removed and placed in a tube containing 0.1 ml. of  $10^{-1}$  dilution of EDTA. This tube was held at  $25^\circ \text{C}$ . for later analysis. After 10 minutes another 10 ml. was removed from the original suspension and added to a tube containing 0.1 ml. of the  $10^{-1}$  dilution of EDTA. This was immediately assayed for viable cell count, and the remainder was held at  $25^\circ \text{C}$ . for subsequent analysis. Samples were taken at 20, 30, 60, and 120 minutes and treated as the sample taken at 10 minutes. All chelated samples were reassayed after 2 hours at  $25^\circ \text{C}$ . and again after 24 hours at the same temperature.

Similar trials were performed with a zinc solution, using  $1.0 \times 10^{-4}$  molar (6.5 p.p.m.)  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  as the final concentration of zinc.

Since buffered distilled water had shown an adverse effect over a 2-hour period, it was included in this study. Deionized (Crystalab Deeminizer) distilled water was also included. Samples of these waters were chelated at the various time intervals described.

# Susceptibility of New Mexico Rodents to Experimental Plague

By R. HOLDENRIED, Ph.D., and S. F. QUAN, Ph.D.

DURING the last three decades, extensive studies have been made to elucidate the plague vector capacity of many flea species infesting wild rodents (1). On the other hand, there has been a lack of adequate investigation concerning the susceptibility to *Pasteurella pestis* infection of the wild rodent hosts of these fleas. Until both factors, vector potential and host susceptibility, are determined, the ecology of sylvatic plague will be difficult to understand. A flea whose natural host is refractory to the development of *P. pestis* bacteremia is unlikely to be a plague vector.

In the early laboratory studies of the susceptibility of wild rodents to *P. pestis*, McCoy (2, 3) and McCoy and Smith (4) established that several species of animals succumbed to experimental infection. Subsequently, other

rodents of these species were found in the field infected from natural sources. Although these investigators produced infection in seven species of rodents, the relative susceptibility of these animals to plague infection could not be evaluated from their data because the number of bacteria either injected or introduced by skin scarification was not recorded. But a rough comparison of species susceptibility was presented. For example, all 19 inoculated California ground squirrels (*Citellus beecheyi*) died of plague while only 8 of 15 inoculated valley pocket gophers (*Thomomys bottae*) died, an indication that of these 2 species the ground squirrel was more susceptible.

Later, from an extensive series of investigations on California ground squirrels, Meyer (5) concluded that young squirrels were more susceptible than adults; adult males were more susceptible than adult females; squirrels from a known plague focus were more resistant to infection than were squirrels from a plague-free area.

For detailed comparisons of the susceptibility of various animal species to plague, Meyer's work indicated the need for considering the plague history of the area supplying the experimental animals, as well as their age and sex.

With this background, the ecology of wild rodents and their ectoparasites was studied at the Santa Fe Field Station of the Communicable Disease Center, Public Health Service.

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metals, 0.16 p.p.m. of copper or 6.5 p.p.m. of zinc, were the most deleterious tested. Even buffered distilled water was responsible for loss of approximately 99.7 percent of the cells within a 24-hour period. In deionized water 98.0 percent of the cells were gone within 24 hours.

EDTA in dilutions of  $10^{-2}$  to  $10^{-6}$  was found to be nontoxic for *E. coli* cells. Greater dilutions were of no value in maintaining cell viability.

The Public Health Service Drinking Water Standard sets 3.0 mg. per liter (3.0 p.p.m.) as the upper limit for copper and 15.0 mg. per liter (15 p.p.m.) as the upper limit for zinc (11). Both of these limits exceed the amounts of these metals used in our experiments. Copper and zinc in the quantities used were shown to increase materially the rate of cell count decrease of *E. coli* as compared with the rate for buffered or deionized distilled water. Addition of EDTA to samples of these waters, taken at various time intervals, resulted in a reduced rate of decrease in the cell count, the amount of reduction depending upon the time the sample was taken. For example, in a sample from water containing copper (0.16 p.p.m.) the percentage of survivors was reduced to 0.08 after 2 hours and to approximately zero shortly thereafter. The addition of EDTA at the time of sampling resulted in approximately 69.0 percent of the cells remaining viable after 2 hours and 40.0 percent after 24 hours. Similar increased recovery was shown for the other waters tested.

Several trials, not described in this report, have been run on samples of rural water supplies. In some samples, the addition of EDTA seemed to promote growth of the coliforms when the samples were stored at 25° C., whereas without EDTA, there was a decrease in numbers of cells during storage. This effect of EDTA, of course, has its disadvantages, in that it tends to give an overestimation of coliform density. On the other hand, would it not be better to find positive those water sources that previously have been reported negative because of a loss of viable cells from the time the sample was taken until it was tested in the laboratory than to report them as safe supplies? The addition of EDTA to samples might be of value in the isolation of enteric pathogens from

waters. Studies of this possibility are now being undertaken in this laboratory.

## Summary and Conclusion

In laboratory experiments by the Tennessee Department of Public Health, the addition of the chelating agent ethylenediamine tetra acetic acid to samples of various waters (water containing copper or zinc, buffered distilled water, and deionized water) materially reduced the rate of decrease in *Escherichia coli* cells. It appears that, for periods up to 24 hours, chelating agents would be of value in maintaining the coliform index near the level existing at the time the sample is taken.

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ification into mice. On death, the subinoculated mice were subjected to the same procedure followed for the test animals.

To investigate the possible development of latent infections, some of the animals that had survived at least 21 days after inoculation were sacrificed. Their spleen, liver, and, if present, enlarged lymph nodes, were pulped and inoculated into guinea pigs or mice.

Eleven rodents that survived previous inoculations were inoculated intraperitoneally with 0.5 ml. of plague toxins prepared according to the method used by Quan and associates (7) and Goodner and associates (8).

## Results and Discussion

A total of 398 wild rodents of 21 species and 105 white control mice were inoculated with varying numbers of plague organisms. The wild rodent species ranged in susceptibility to infection from being as uniformly sensitive as the control mice to complete refractoriness. The  $LD_{50}$  for the laboratory mouse was about 7 bacilli.

The species found as homogeneously susceptible as the control strain of laboratory mouse were:

- Reithrodontomys megalotis aztecus* Allen, western harvest mouse
- Perognathus flavus flavus* Baird, silky pocket mouse
- Peromyscus leucopus tornillo* Mearns, white-footed mouse
- Peromyscus truei truei* (Shufeldt), piñon mouse
- Neotoma albigula albigula* Hartley, whitethroat woodrat
- Neotoma mexicana fallax* Merriam, Mexican woodrat
- Eutamias minimus operarius* Merriam, least chipmunk (probably as susceptible)

Although some individuals of the following species were resistant, the majority died of plague after infection with 1 to 1,000 mouse  $LD_{50}$ :

- Peromyscus maniculatus rufinus* (Merriam), deer mouse
- Peromyscus boylii rowleyi* (Allen), brush mouse
- Peromyscus nasutus nasutus* (Allen), rock mouse
- Neotoma micropus canescens* Allen, southern plains woodrat
- Eutamias quadrivittatus quadrivittatus* (Say), Colorado chipmunk

Those moderately resistant to infection (more than 1,000 mouse  $LD_{50}$ ) were:

- Citellus variegatus grammurus* (Say), rock squirrel
- Citellus spilosoma marginatus* Bailey, spotted ground squirrel
- Microtus longicaudus mordax* (Merriam), longtail vole
- Onychomys leucogaster pallascens* Merriam, northern grasshopper mouse
- Thomomys bottae nervagus* Merriam, valley pocket gopher
- Thomomys talpoides fossor* Allen, northern pocket gopher

On the other hand, the following were refractory to intracutaneous inoculations of about a million mouse  $LD_{50}$ :

- Dipodomys spectabilis baileyi* Goldman, bannertail kangaroo rat
- Dipodomys ordii medius* Setzer, Ord kangaroo rat

The number of rodents in each species dying of plague after the experimental infection and the total number of rodents inoculated at each dilution are tabulated as fractions in tables 1 and 2.

*Reithrodontomys megalotis aztecus* and *Perognathus f. flavus* were more susceptible to experimental plague infection than were the white mice controls. The five species of *Peromyscus* were quite susceptible and succumbed to about the same number of organisms required to kill the controls, but certain individuals of both *P. maniculatus rufinus* and *P. n. nasutus* showed a fairly high degree of resistance. None of the three species of *Neotoma* survived inoculation of 10,000 organisms, but a few survived doses of less than 10 organisms. Reinoculated *Neotoma* survivors succumbed to 1,000 organisms. It was found that the diluted bacterial suspension initially inoculated into these animals was noninfectious. *Microtus*, *Citellus*, and *Eutamias* appeared to be more resistant than the *Neotoma*.

*Thomomys* and *Onychomys* showed a high degree of resistance, especially upon reinoculation. This may have been the result of an immunizing effect of the first inoculation. Two *Thomomys* that survived two previous intracutaneous inoculations succumbed to 100 million organisms inoculated intraperitoneally. Both species of *Dipodomys* were amazingly resistant

We present here the results of testing locally trapped adult rodents for susceptibility to experimental plague.

### Procedure

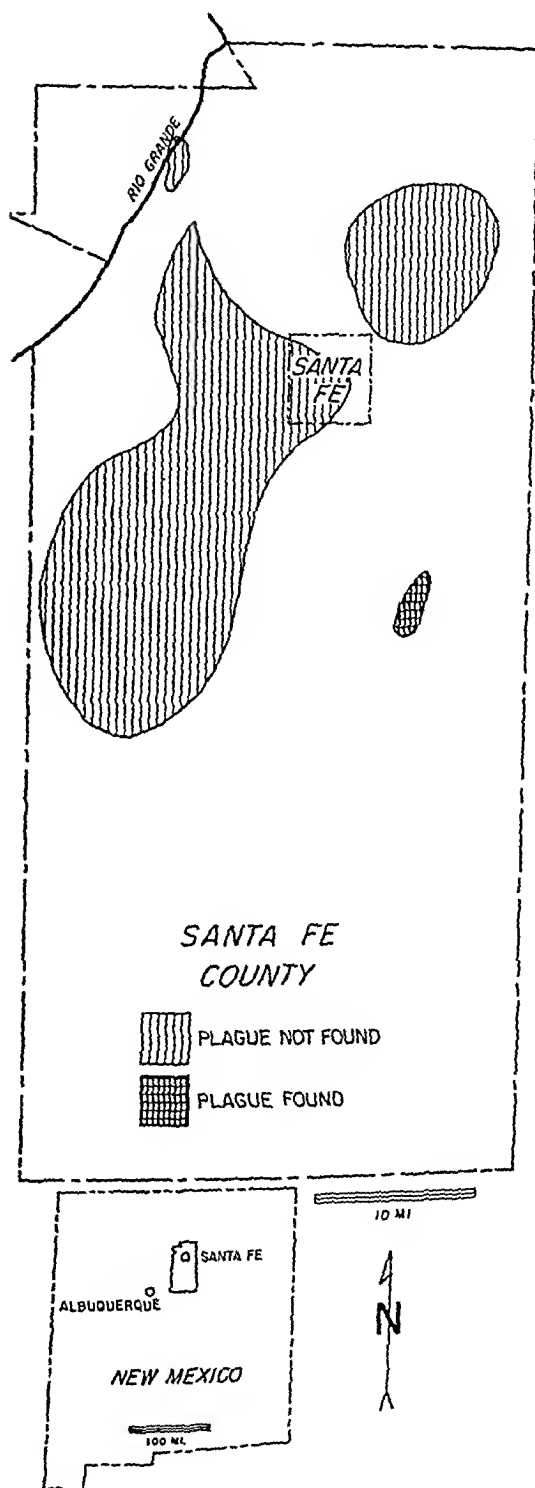
Test animals were trapped between September 21 and December 17, 1953. After a liberal dusting with pyrethrum powder to kill their fleas, the rodents were held in the Santa Fe laboratory for testing between October 21 and December 18, 1953.

The inoculum was obtained from 24-hour cultures of *P. pestis*, Alexander strain, New Mexico (6), grown at approximately 28° C. in brain-heart infusion broth and in dilutions of the broth varying from 10<sup>-1</sup> to 10<sup>-8</sup> in 1 percent peptone water. The number of viable organisms in an inoculum was calculated from the counts of the bacterial colonies, obtained by spreading on each of several blood-agar plates 0.2 ml. portions of 10<sup>-6</sup> and 10<sup>-7</sup> dilutions of the culture and allowing the bacteria on these agar plates to grow for 2 days in a 28° C. incubator. White laboratory mice, Princeton strain, inoculated with dilutions of the cultures, served as susceptible controls.

Each rodent in the experiments received initially 0.05 ml., inoculated intracutaneously into a shaven area over the right thigh. Intracutaneous inoculations were used on the assumption that they simulate infection by flea bites more closely than either subcutaneous or intraperitoneal inoculations. Some survivors of the initial injection were reinoculated intracutaneously 17 days after the first inoculation. A few survivors of the second injection were inoculated a third time. This was done intraperitoneally with 0.5 ml. of undiluted culture 41 days later.

On death, animals were autopsied. Evidence that plague was the cause of death was obtained from microscopic examination of stained smears of lymph nodes, spleen, liver, or heart blood exhibiting the typical bipolar bacillus; from appropriate macroscopic pathology; and from plague organisms identified on blood-agar culture of tissue smears. Tissues from test animals failing to show plague by one or more of these three processes were subinoculated by scar-

Areas in Santa Fe County, N. Mex., from which rodents were collected for susceptibility tests to experimental plague infection.



(table 2) are shown in table 3. The mortality index (10) is the ratio of the percent mortality to the average survival time in days and is identical to the mouse protective index as originally used by Meyer and Foster (11) to evaluate human serum with mice. The mortality index for the species of rodents that were homogeneously susceptible to infection varied directly with the dose of the infecting inoculant, whereas the index for the heterogeneously responding species (*P. maniculatus rufinus*) did not. The calculated range of the 95 percent fiducial probability is well within the observed results.

Three *P. maniculatus rufinus* yielded tissues infected with *P. pestis* 25 to 34 days after they received their last inoculation. These animals showed no obvious signs of illness prior to the

time they were sacrificed. The significance of the recovery of virulent *P. pestis* in tissues of apparently healthy mice, 5 weeks after inoculation, is not known. Obviously, the ultimate fate of the infecting organisms, had the mice continued to live, could not be determined. Of all the species tested, only *P. maniculatus rufinus* was found to harbor the organisms while remaining alive in apparent good health.

Olitzki (12) recently reported the isolation of plague bacilli from the spleen of *Microtus guentheri* and from the abscess at the inoculation site 6 weeks after the subcutaneous injection of 1 million bacteria. At the George Williams Hooper Foundation, University of California, Quan (unpublished data) recovered virulent *P. pestis* from apparently healthy

Table 2. Comparison of susceptibility to experimental plague in rodents from plague and nonplague foci: number of rodents dying per number inoculated with varying numbers of *Pasteurella pestis* organisms

Rodent species <sup>1</sup>	Original inoculation								First reinoculation	
	10 <sup>0</sup>	10 <sup>5</sup>	10 <sup>4</sup>	10 <sup>3</sup>	10 <sup>2</sup>	10	1-5	<1	10 <sup>5</sup>	10 <sup>4</sup>
<i>Neotoma albigula albigula</i> :										
Plague focus			3/3	4/4		3/5	2/5			
Plague free			4/4			2/3	4/6	0/2		
<i>Peromyscus truei truei</i> :										
Plague focus			6/6	6/6	6/6	6/6				
Plague free		4/4	13/13	10/10	10/10	7/10	1/3			2/2
<i>Peromyscus leucopus tornillo</i> :										
Plague focus				4/4	5/5	5/5	1/5			
Plague free			5/5	5/5	5/5	4/6	5/9			0/1
<i>Peromyscus maniculatus rufinus</i> :										
Plague focus	5/6		6/6		5/6		0/5			
Plague free			3/4	6/7	7/9	8/8	6/12		0/5	

<sup>1</sup> Species totals for plague-free and plague-focus areas are shown in table 1.

Table 3. Mortality indexes according to number of *Pasteurella pestis* inoculated and LD<sub>50</sub> doses of four rodent species and control mice

Rodent species	Mortality index <sup>1</sup>					LD <sub>50</sub> <sup>2</sup>	
	10 <sup>4</sup>	10 <sup>3</sup>	10 <sup>2</sup>	10	<10	Dose	95 percent fiducial limits
<i>Neotoma albigula albigula</i>		33.3	26.4	12.9	10.0	2.6	1.1-5.8
<i>Peromyscus truei truei</i>	36.4	33.3	32.8	29.1	16.7	2.8	1.3-6.2
<i>Peromyscus leucopus tornillo</i>		28.6	31.3	25.7	9.1	3.8	2.0-7.2
<i>Peromyscus maniculatus rufinus</i>	17.0	25.7	19.8	6.2	0	38.0	1.4-2040
White control mice	32.2	27.0	20.6	17.6	7.6	7.0	4.0-10.0

<sup>1</sup> Percent mortality per average life of rodents that died (in days); same as mouse protective index used by Meyer and Foster (11).

<sup>2</sup> Method of Litchfield and Wilcoxon (10).

Table 1. Number of rodents dying of plague per number inoculated with varying numbers of *Pasteurella pestis* organisms

Rodent species	Original inoculation									First reinoculation <sup>1</sup>			
	10 <sup>7</sup>	10 <sup>6</sup>	10 <sup>5</sup>	10 <sup>4</sup>	10 <sup>3</sup>	10 <sup>2</sup>	10	1-5	<1	10 <sup>7</sup>	10 <sup>5</sup>	10 <sup>4</sup>	10 <sup>3</sup>
White mice controls <sup>2</sup>		6/6	6/6	16/17	17/17	15/16	14/16	4/16	0/11				
<i>Reithrodontomys megalotis aztecus</i>				4/4				4/4					
<i>Perognathus flavus flavus</i>				1/1				3/3					
<i>Peromyscus boylii rowleyi</i>				5/6				5/5				1/1	
<i>Peromyscus leucopus tornillo</i>				5/5	9/9	10/10	9/11	6/14				0/1	
<i>Peromyscus maniculatus rufinus</i>		5/6		9/10	6/7	12/15	8/8	6/17			0/5		
<i>Peromyscus nasutus nasutus</i>				6/7				3/5				2/2	
<i>Peromyscus truei truei</i>			4/4	19/19	16/16	16/16	13/16	1/3				2/2	
<i>Neotoma albigula albigula</i>				7/7	4/4		5/8	6/11	0/2				
<i>Neotoma mexicana fallax</i>				4/4			1/1	3/6	1/2				2/2
<i>Neotoma micropus canescens</i>				6/6			2/3	4/8	0/3				2/2
<i>Eutamias minimus operarius</i>				6/6	1/1			4/6					2/2
<i>Eutamias quadrivittatus quadrivittatus</i>				3/4				3/5			3/3		
<i>Citellus lateralis lateralis</i>			2/2										
<i>Citellus spilosoma marginatus</i>				3/4				3/4			1/2		
<i>Citellus variegatus grammurus</i>				3/5				0/4			4/6		
<i>Microtus longicaudus mordax</i>				4/5	0/6			1/4			2/4		
<i>Onychomys leucogaster pallescens</i>	1/1			1/4				0/5		2/4	1/4		
<i>Thomomys talpoides fossor</i>	1/1		0/1	0/3				0/4		2/7			
<i>Thomomys bottae nervagus</i>			0/2										
<i>Dipodomys ordii medius</i>	0/2	0/2	0/4	0/9				0/5		0/10			
<i>Dipodomys spectabilis baileyi</i>	0/2		0/3	0/4				0/4		0/7			

<sup>1</sup> First reinoculation given 17 days after the original.

<sup>2</sup> Albino mice controls for all experiments.

to infection. None died upon intracutaneous inoculations of as many as 10 million organisms, but some succumbed to 100 million organisms inoculated intraperitoneally.

The number tested in each rodent species was insufficient to indicate possible variation in susceptibility between sexes and different ages. The lack of an opportunity to experiment at another time than the October-December period leaves unanswered the possibility that there may be a seasonal change in host receptiveness to infection.

Following the completion of the plague susceptibility experiments some of the surviving rodents were injected with plague toxins. Each of these animals received a toxic dose equivalent to 600 times the LD<sub>50</sub> for white laboratory mice. Each of two *Onychomys* receiving toxins died. The two *Thomomys*, one each of species *talpoides* and *bottae*, also succumbed. Three of the four *Dipodomys ordii medius* and one of three *Dipodomys spectabilis baileyi* were killed. All deaths occurred within 24 hours after the injection of poisons. The controls for each species survived for more than 3 weeks.

For four species of the rodents, the susceptibility to *P. pestis* of rodents from a plague-free area was compared with that of animals trapped in an area in which plague-positive rodents and fleas had been found (9). The map shows the proximity of the two areas. No difference was observed in the degree of susceptibility of the two sets of rodent species, *Neotoma a. albigula*, *Peromyscus t. truei*, *Peromyscus leucopus tornillo*, and *Peromyscus maniculatus rufinus* (table 2). These results contrast with the observations made by Meyer (5) on California ground squirrels. The reasons for these contrasting observations are not readily apparent. It is possible that the animals trapped in the plague-focus area were from populations without previous plague experience. Actual geographic limits of the plague focus could not be delineated, and no evidence could be found to substantiate an assumption that the infection spread throughout the trapping area. The difference between Meyer's observations and those in the present study may possibly be explained by the different species of hosts used.

The mortality indexes of four rodent species

# General Hospital and Nursing Home Beds in Urban and Rural Areas

By JERRY SOLON, M.A., and ANNA MAE BANEY, B.A.

**H**OSPITAL and other medical facilities are distributed in particular patterns. Understanding the existing distribution patterns and the factors producing or accompanying them is an important step toward planning for facilities properly distributed to meet health needs.

This report analyzes the relative availability of general hospital and nursing home beds in terms of counties classified according to their urban or rural character. Within this framework it examines the distribution of beds in relation to per capita income, proportion of older people, and supply of medical personnel. This approach permits a more detailed examination of rural-urban differences than was possible through analysis of such differences based on general hospital service areas (1).

The study is based in part on data on general hospitals submitted for 1953 in State hospital plans for the Hospital Survey and Construction (Hill-Burton) Program. Information on skilled nursing homes was obtained in a 1954 national survey conducted by the Public Health Service. Detailed explanation of these and other data used in this report is given in Public Health Monograph No. 44.

## Urban-Rural Classification

For the purpose of identifying the existing distribution patterns of beds in general hospitals and nursing homes, the county is a useful analytical unit, although it does not necessarily constitute a "trading area" in actual use of health facilities. However, ready statistical information pertaining to population and socioeconomic characteristics is available on a county basis. It is through correlation with such information that the distribution patterns of medical resources become understandable.



Public Health

MONOGRAPH

No. 44

The accompanying article supplements and reexamines, from another avenue of approach, the ground covered in Public Health Monograph No. 44, published concurrently with this issue of Public Health Reports. The monograph analyzes the availability of general hospital and nursing home beds in the framework of general hospital "service areas," which correspond to trading areas for hospital services. The authors are health program analysts with the Division of Hospital and Medical Facilities, Public Health Service.

Readers wishing the more extensive analysis may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities, and in selected public libraries.

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Solon, Jerry, and Boney, Anna Mae: General hospitals and nursing homes: Patterns and relationships in their geographic distribution. Public Health Monograph No. 44 (Public Health Service Publication No. 492). 56 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956. Price 40 cents.

guinea pigs killed more than 30 days after inoculation. Although recovery of virulent microorganisms from apparently healthy animals, 4 to 6 weeks after inoculation, may suggest how the plague bacillus could be maintained in wild rodents during interepizootic periods, this finding cannot be regarded as latent plague (13, 14) without proof that disease will finally occur (15).

### Summary

A total of 398 wild rodents of 21 species were inoculated intracutaneously with 0.05 ml. of aqueous suspensions containing various numbers of *Pasteurella pestis* (Alexander strain, New Mexico) to test their susceptibility to plague infection in comparison with white laboratory mice inoculated identically.

The wild rodent species ranged in susceptibility from homogeneous sensitivity equal to that of the control mice to complete resistance.

The majority of the rodents that survived plague inoculation, regardless of species, died of toxemia after receiving about 650 LD<sub>50</sub> of plague toxins intraperitoneally.

The comparison of four species, *Neotoma albigula albigula*, *Peromyscus truei truei*, *Peromyscus leucopus tornillo*, and *Peromyscus maniculatus rufinus*, trapped in an area where plague was found with those collected from a plague-free area, demonstrated no differences in susceptibility to experimental *P. pestis* infection.

Since the available number of animals of any one species tested was small, such factors as sex and age could not be evaluated.

The possible effect of seasons on the susceptibility of the rodents was not investigated. The persistence of plague in the area where it occurred was not determined.

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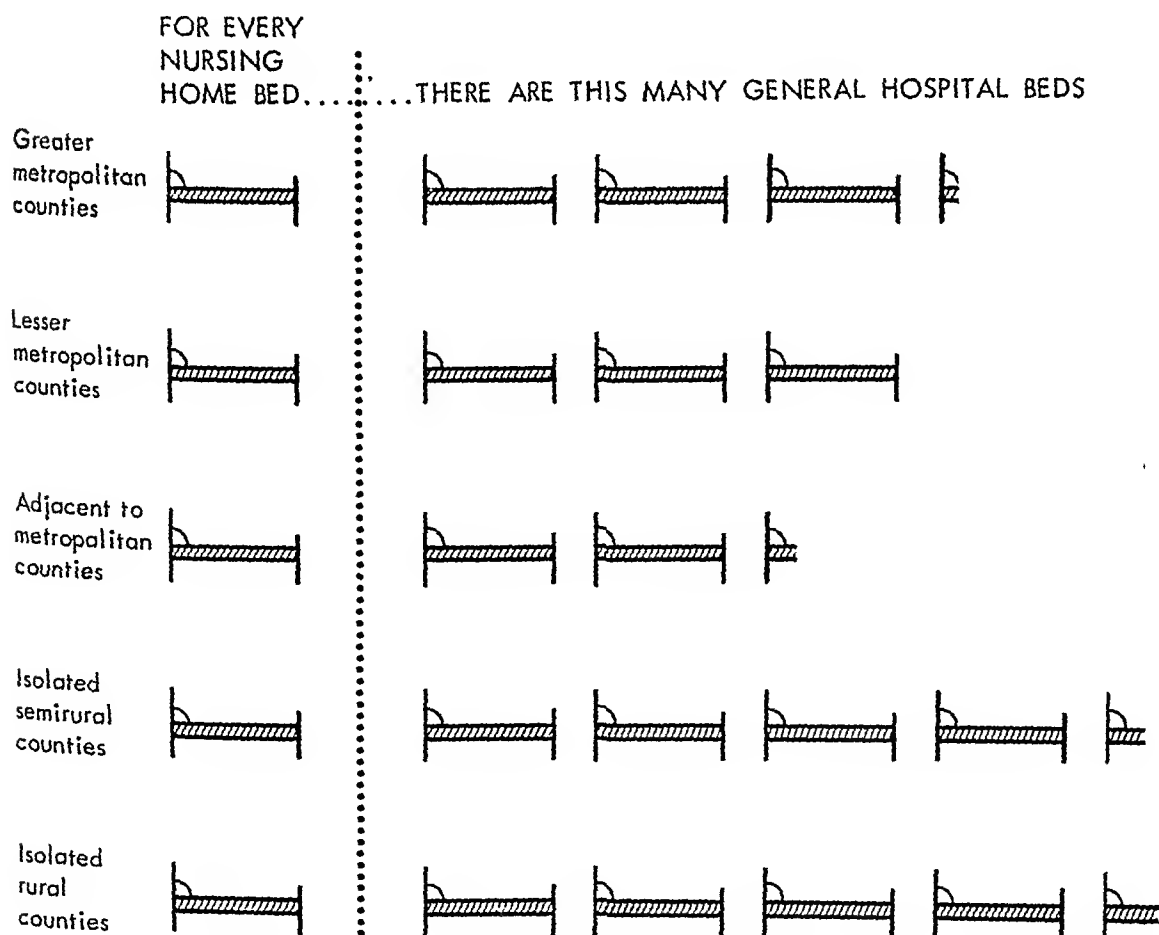
**Table 2. Availability of beds in general hospitals and skilled nursing homes, by urban-rural character of county**

Character of county	Number of beds		Beds per 1,000 population <sup>2</sup>	
	General hospitals, 1953	Nursing homes, 1954 <sup>1</sup>	General hospitals	Nursing homes
All counties.....	564, 826	180, 000	3. 7	1. 2
Metropolitan and adjacent.....	425, 168	147, 700	3. 9	1. 4
Greater metropolitan.....	185, 738	59, 800	4. 1	1. 3
Lesser metropolitan.....	172, 524	58, 000	4. 2	1. 4
Adjacent.....	66, 906	29, 900	2. 8	1. 3
Isolated.....	139, 658	32, 300	3. 4	. 8
Semirural.....	125, 042	29, 000	3. 8	. 9
Rural.....	14, 616	3, 300	1. 8	. 4

<sup>1</sup> Partly estimated, based on actually reported 6,531 homes and 171,106 beds.

<sup>2</sup> Based on 1950 population, as shown in table 1. Ratios derived from sums of populations and beds of counties in respective groups.

**Figure 1. Ratio of general hospital beds to skilled nursing home beds, by urban-rural character of county, 1953-54.**



The county classification system used here was first developed in the 1946 American Academy of Pediatrics study of child health services (2) and was brought up to date on the basis of 1950 data by Pennell and Altenderfer (3). In this classificatory scheme, size of population and nearness to densely populated areas determine the designation of each county as:

*Greater metropolitan.* Counties included in any one of 14 "standard metropolitan areas" of 1,000,000 population or more. A "standard metropolitan area" consists of a county, or group of adjoining counties, which forms an integrated economic and social unit around a central city or cities of 50,000 or more (4).

*Lesser metropolitan.* Counties included in "standard metropolitan areas" of less than 1,000,000 population.

*Adjacent.* Counties that touch a metropolitan county as defined above.

*Isolated semirural.* Any other county containing at least one incorporated place of 2,500 or more population.

*Isolated rural.* Counties having no incorporated community of 2,500 or more.

This urban-rural characterization of counties has an especially significant application to the manner in which medical facilities are distributed. The metropolitan and adjacent counties represent areas served by, or readily accessible to, medical facilities available in larger urban centers. The isolated counties, however, do not have easy accessibility to a metropolitan center and are therefore usually limited to the generally less comprehensive medical services which can be secured locally.

Table 1 shows the number of counties in each of the urban-rural categories and the corre-

sponding distribution of population. One-third of the counties in the United States, those identified as metropolitan and adjacent, with nearly three-fourths of the population, are accessible to the medical resources concentrated in large urban centers. The remaining two-thirds of the counties, designated as isolated, with about one-fourth of the population, are comparatively remote from the medical facilities of metropolitan centers.

### Distribution of Beds

Metropolitan counties have the most general hospital beds, averaging over 4 per 1,000 population (table 2). Isolated rural counties have the fewest, with an average of less than 2 per 1,000 population.

Isolated semirural counties have relatively more general hospital beds (3.8 per 1,000 population) than do counties adjacent to metropolitan areas (2.8 per 1,000). Obviously, the location of a county adjacent to metropolitan medical services reduces the need for beds in the county proper.

Beds in skilled nursing homes show a somewhat different pattern of distribution (table 2). Metropolitan and adjacent counties have, proportionately, about equal numbers of nursing home beds (average of 1.3 to 1.4 per 1,000 population). The availability of nursing home beds diminishes as the counties become more rural (isolated semirural counties, 0.9 per 1,000 population, and isolated rural counties, 0.4 per 1,000).

Table 1. Distribution of counties and their population by urban-rural character of county, 1950

Character of county	Number of counties	Population	Percentage distribution	
			Counties	Population
All counties	3, 076	150, 697, 361	100. 0	100. 0
Metropolitan and adjacent	1, 020	109, 272, 372	33. 2	72. 5
Greater metropolitan	71	44, 946, 386	2. 3	29. 8
Lesser metropolitan	204	40, 631, 787	6. 6	27. 0
Adjacent	745	23, 694, 199	24. 2	15. 7
Isolated	2, 056	41, 424, 989	66. 8	27. 5
Semirural	1, 160	33, 177, 227	37. 7	22. 0
Rural	896	8, 247, 762	29. 1	5. 5

SOURCE: Based on data in reference 3.



**Table 4. Availability of beds in general hospitals and skilled nursing homes, by per capita income of county, by urban-rural county type, 1953-54**

Per capita income of county, 1950	Total population <sup>1</sup>	Number of beds		Beds per 1,000 population	
		General hospitals	Nursing homes	General hospitals	Nursing homes <sup>2</sup>
All counties.....	150, 697, 361	564, 826	171, 106	3. 7	1. 2
Less than \$500.....	4, 526, 178	5, 962	520	1. 3	0. 1
\$500-\$999.....	31, 416, 731	78, 496	16, 661	2. 5	. 5
\$1,000-\$1,499.....	61, 033, 532	235, 205	78, 216	3. 9	1. 3
\$1,500 and over.....	53, 710, 920	245, 163	75, 709	4. 6	1. 4
Metropolitan and adjacent counties.....	109, 272, 372	425, 168	140, 363	3. 9	1. 4
Less than \$500.....	1, 089, 100	1, 266	169	1. 2	. 2
\$500-\$999.....	11, 309, 532	23, 936	7, 714	2. 1	. 7
\$1,000-\$1,499.....	44, 539, 219	162, 182	58, 662	3. 6	1. 3
\$1,500 and over.....	52, 334, 521	237, 784	73, 818	4. 5	1. 4
Isolated counties.....	41, 424, 989	139, 658	30, 743	3. 4	. 8
Less than \$500.....	3, 447, 078	4, 696	351	1. 4	. 1
\$500-\$999.....	20, 107, 199	54, 560	8, 947	2. 7	. 4
\$1,000-\$1,499.....	16, 494, 313	73, 023	19, 554	4. 4	1. 2
\$1,500 and over.....	1, 376, 399	7, 379	1, 891	5. 4	1. 4

<sup>1</sup> 1950 census.

<sup>2</sup> Bed ratios for national and county-type totals are computed on estimated total number of beds (cf. table 2) rather than on actually reported beds as shown here.

### County Characteristics

The availability of beds may be associated with certain measurable characteristics of counties other than their urban-rural character. Per capita income may be one such factor; its influence on the supply of general hospital beds has been demonstrated in earlier studies (2, 5). The proportion of the population aged 65 years and over may be influential, in view of generally greater use of both hospital and nursing home facilities by this age group. Another related factor may be the relative availability of medical personnel, including physicians and professional and practical nurses.

#### *Per Capita Income*

That the supply of beds in general hospitals and skilled nursing homes in counties tends to increase with per capita income is evident from table 4.

The volume of beds in nursing homes shows proportionately greater increases with increasing income levels than does the volume of beds in general hospitals. However, the individual counties do not adhere closely to the overall

tendency which shows nursing home beds increasing with income level. Rather, the pattern represents an average of county experiences which are widely dispersed about the general trend. The increase of general hospital beds with increase in per capita income, on the other hand, is more consistently displayed county by county. (The more consistent association of general hospital beds with per capita income is reflected in a correlation coefficient of .45, compared with a correlation coefficient of .27 for skilled nursing home beds—both significant at the 1-percent confidence level.)

#### *Older Population*

The proportion of the county population aged 65 years and over is as significant as per capita income in relation to nursing home beds (correlation coefficient of .28). The supply of general hospital beds, however, shows no relation to the number of older people in the area. As figure 2 indicates, this situation is found in both urban and rural counties.

The association of aged population with the availability of nursing home beds is independ-

Nationally, there is one skilled nursing home bed for every 3.3 general hospital beds. Figure 1 expresses the relationship between the availability of general hospital beds and skilled nursing home beds in the several types of counties. One skilled nursing home bed is available in metropolitan counties for every 3.0 general hospital beds; in adjacent counties, for every 2.2; and in isolated counties, for every 4.3 general hospital beds.

Areas surrounding metropolitan counties thus are comparatively favored in the location of nursing homes. They maintain proportionately as many nursing home beds as do the neighboring metropolitan counties, on an average, although their supply of general hospital beds is much below that of the metropolitan counties. This suggests a differential geographic pattern of development between general hospitals and nursing homes. The greater concentration of both hospitals and nursing homes in urban areas as opposed to rural areas may be explained in large part on the basis of economic factors. Nursing homes, in addition, have developed to a greater extent in urban areas as a consequence of the distinctive housing and family living arrangements characteristic of cities. They have, however, gravitated largely to the fringes of the cities, whereas hospitals have tended to be centrally located. Differential land values have been a strong factor in inducing nursing homes to locate away from expensive in-city sites, particularly in seeking larger tracts of land to provide some grounds

around the home. This phenomenon has probably come about through the conversion to nursing homes of certain types of residences typically found in more outlying residential areas.

All of the patterning observed in the foregoing data represent central tendencies within a wide range of bed availability. In fact, among themselves, the counties of any one urban or rural type show a broad range of availability of beds.

#### Interrelationship in Availability of Beds

As we have noted in treating each of the types of counties as a whole, the distributions of beds in general hospitals and nursing homes are similar in some respects and dissimilar in others. Of further interest is the question of how the relative volumes of beds correspond within individual counties.

Table 3 presents the average availability levels of beds in skilled nursing homes for counties with different levels of supply of general hospital beds. Despite some tendency for levels of nursing home beds to increase with increasing supplies of general hospital beds, many departures from such a pattern occur. Furthermore, the counties represented within any one group by the given bed ratio are actually quite dispersed in their individual ratios. (The low degree of correspondence between the county supply levels of beds in general hospitals and nursing homes is reflected in a simple correlation coefficient of .09.)

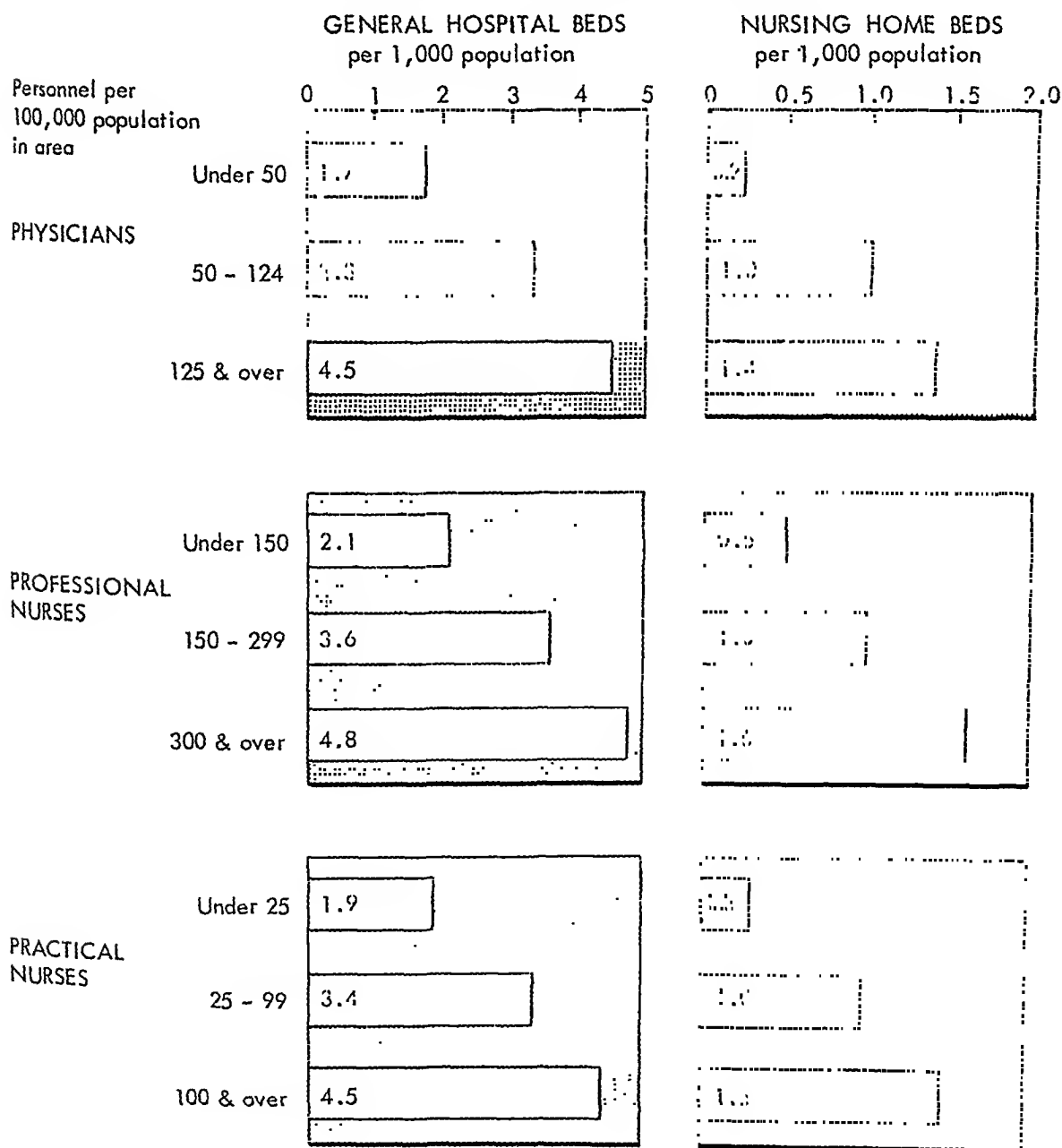
Table 3. Relative availability of beds in skilled nursing homes, by level of availability of beds in general hospitals within each urban-rural county type, 1953-54

General hospital beds per 1,000 population in county	Average nursing home beds per 1,000 population					
	All counties	Greater metropolitan	Lesser metropolitan	Adjacent to metropolitan	Isolated semirural	Isolated rural
Total.....	1.2	1.3	1.4	1.3	0.9	0.4
None.....	0.8	2.2	1.0	0.9	0.6	0.5
Less than 1.0.....	.4	.6	.7	.8	.1	.1
1.0-1.9.....	.8	1.0	1.3	1.0	.5	.3
2.0-2.9.....	1.0	1.1	.9	1.2	.7	.5
3.0-3.9.....	1.2	1.3	1.2	1.4	.8	.3
4.0-4.9.....	1.4	1.4	1.5	1.7	.9	.3
5.0-5.9.....	1.1	.9	1.5	1.0	1.3	.1
6.0-6.9.....	1.3	1.6	1.4	1.3	1.1	.2
7.0 and over.....	1.4	1.5	1.5	1.4	1.1	.2

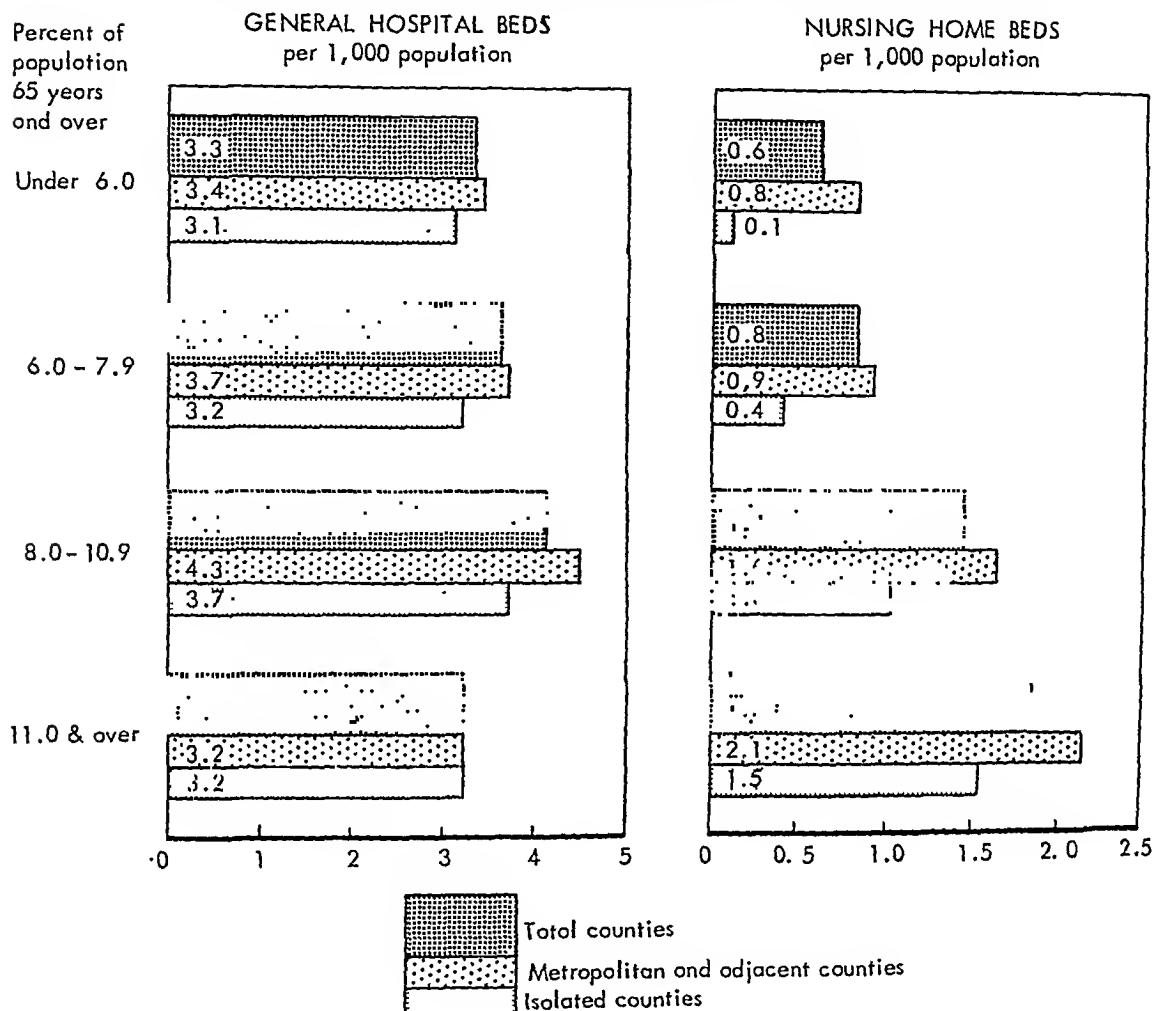
Ratio	Correlation with county bed-popu- lation ratio for—	
	General hospitals	Skilled nursing homes
Physician-population.....	.45	.25
Professional nurse-population.....	.55	.33
Practical nurse-population.....	.33	.22

Removing the influence of county per capita income does in fact reduce the extent of correlation between bed levels and the supply of professional nurses. However, a measure of association remains (partial correlations with general hospital and nursing home beds, respectively, of .39 and .21, compared with the

Figure 3. Average availability of general hospital and skilled nursing home beds among counties with different relative availability of medical personnel.



**Figure 2. Average availability of general hospital and skilled nursing home beds among counties with different proportions of older people, by urban-rural county type.**



ent of the influence of income level. The relationship with age is maintained even among areas of similar income. (Removing the effect of income, the partial correlation of nursing home beds with aged population is .26, similar to the simple correlation of .28 noted above.)

#### *Medical Personnel*

As figure 3 demonstrates, counties with relatively larger numbers of physicians and professional and practical nurses also have, on an average, more general hospital and nursing home beds. This holds true for the different types of urban and rural counties.

County per capita income probably has an

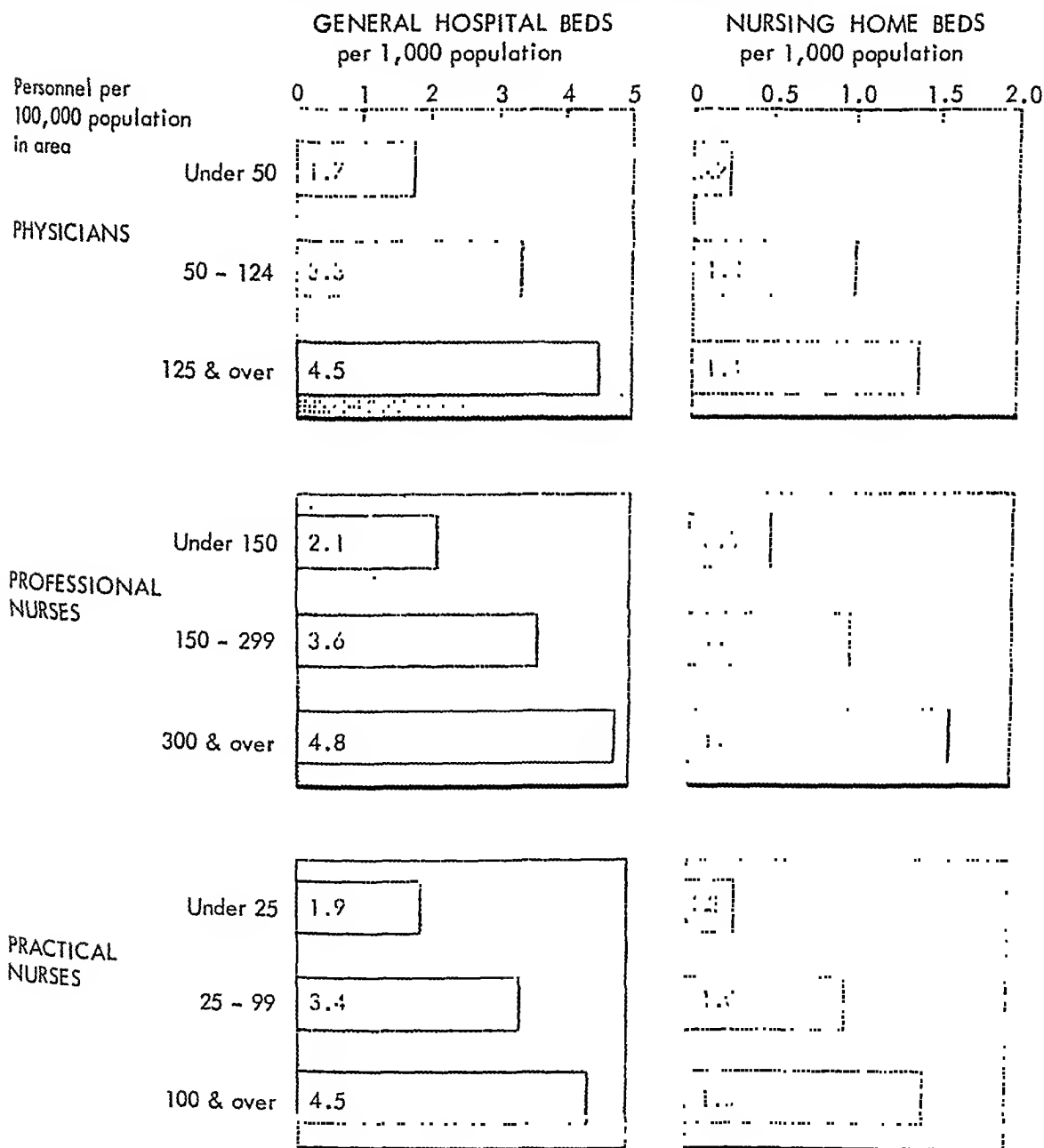
underlying influence here. There is a substantial association between county income levels and the supply of physicians and professional and practical nurses (the three types of medical personnel correlate, respectively, with county per capita income .58, .60, and .29).

To observe the effect of availability of medical personnel alone, with the effect of income removed, the category of professional nurses was examined in detail. This category, as just noted, correlates quite highly with per capita income. It also shows the highest correlation of the three types of medical personnel with the volume of general hospital and nursing home beds.

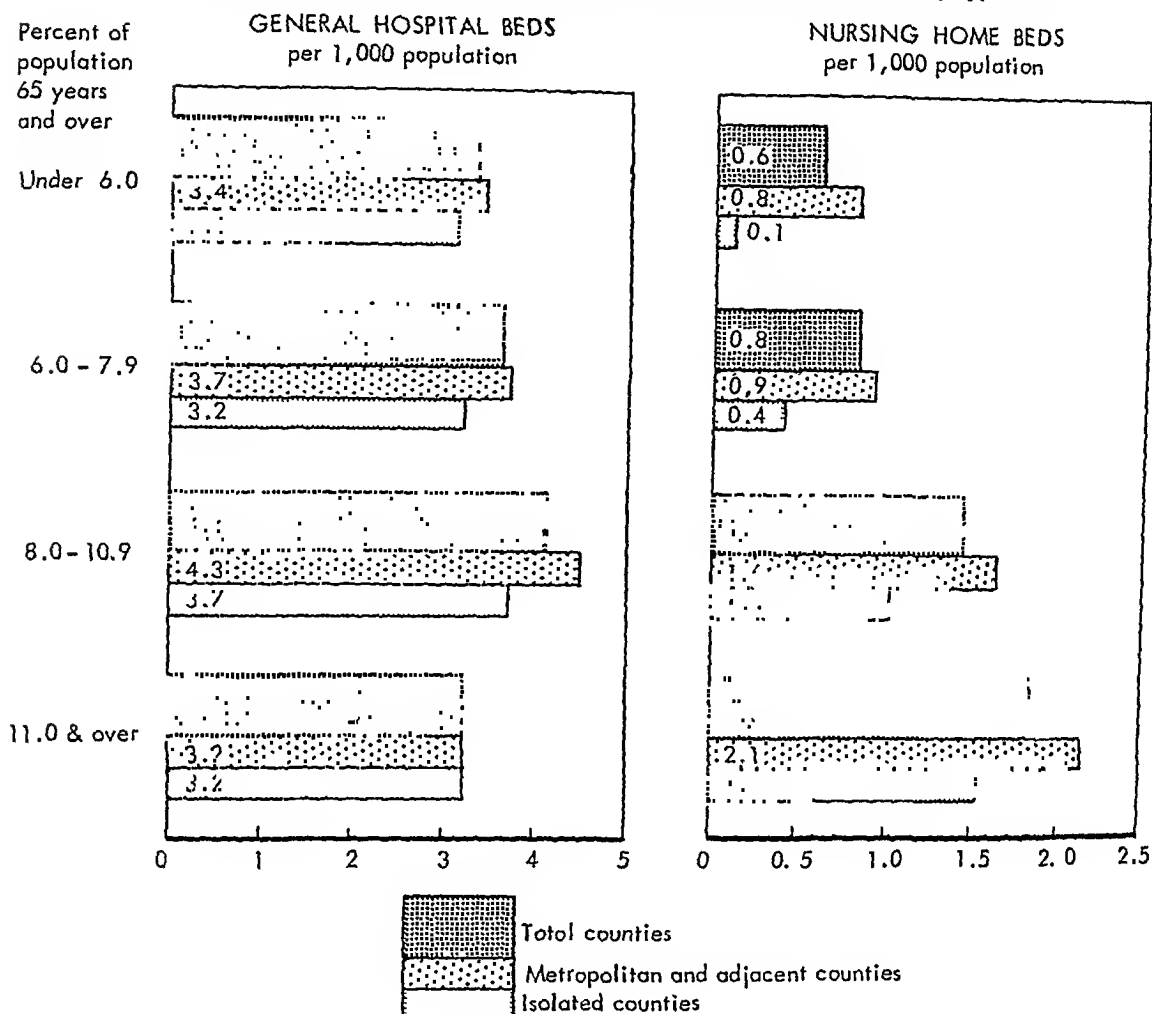
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# Conference Report



Administration building at the Public Health Service Hospital in Carville, La.

## Progress and Potentials in Leprosy Research

A conference on leprosy research, the first sponsored by the Public Health Service's Interbureau Advisory Committee on Leprosy, was held at the Public Health Service Hospital, Carville, La., January 10-11, 1956. In a program planned by the Subcommittee on Leprosy Research, this conference brought together most of the persons in the United States currently studying the disease. Their discussions, which covered bacteriology, animal inoculation, immunology, biochemistry, pathology, metabolism and nutrition, chemotherapy, epidemiology, and clinical observations, are represented here by brief summaries of 25 of the papers.

simple correlations of .55 and .33—all statistically significant).

### *Composite Relationships*

Per capita income and complement of professional nurses emerge from the foregoing analysis as rather significant factors associated with the volume of general hospital and nursing home beds in counties. The relative number of older people in an area is an additional important factor in the supply of nursing home beds.

The supply of professional nurses appears as the most effective correlate of availability of general hospital beds among the several factors studied. The nurse factor operates in the same direction as county income level, itself a major correlate, and further effectively incorporates the influence of income level. (Multiple correlation of general hospital beds with both these factors combined yields a coefficient of .57, no improvement over the simple correlation of .55 with supply of professional nurses by itself.)

In the case of nursing home beds, the combined effect of per capita income, proportion of older population, and professional nurse supply is greater than the effect of any one of these alone (multiple correlation of .42, as compared with simple correlations with these factors, respectively, of .27, .28, and .33). Here again, however, the influence of income is adequately reflected in the factor of professional nurse supply. Consequently, the combined effect of aged population and professional nurses yields as high a correlation (.42) with nursing home beds as the correlation with income level included.

### **Summary**

Metropolitan counties, relative to other types of counties, are best supplied with both general hospital and nursing home beds. Isolated rural counties are the least supplied with both types of beds. The intermediate types of counties exhibit opposing patterns between general hospital and nursing home beds: General hospital beds are in rather low supply in those counties adjacent to metropolitan counties and in high supply in isolated semirural counties. Nursing home beds, in contrast, exist in relatively large

supply in counties adjacent to metropolitan counties and are in much lower supply in isolated semirural counties.

Little correspondence is found, county by county, between the number of general hospital beds and the number of nursing home beds. Although some average tendency is observed for the volume of nursing home beds to increase as general hospital beds increase, great variability among counties obscures the actual relationship.

The availability of beds is moderately correlated with certain socioeconomic factors. Per capita income and supply of medical personnel form a complex which is significantly related to the availability of general hospital beds. Correlating not as highly, but significantly, with these factors is the supply of nursing home beds. The proportion of county population aged 65 years and over apparently influences the supply of nursing home beds positively but reveals no measurable effect on the volume of general hospital beds.

Beyond the relationships examined in this study, there is much that is yet unexplained in the volume of beds established in different areas. For better understanding we must look to more subtle factors in the medical-sociocultural environment.

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chain fatty acids. Intermediate types still metabolize the fatty acids, but not the succinates and usually not the acetates. Tubercle bacilli metabolize the fatty acids, but rather poorly. John's bacillus metabolizes only the short-chain fatty acids. Murine lepra bacilli metabolize none of these substances. This leads to the conclusion, said Gray, that they lie at the extreme pole of the sequence.

Studies of the behavior of various mycobacteria under varying oxygen tensions indicate that, whereas saprophytes may not grow in the absence of oxygen, they are not injured by the condition. However, anaerobic conditions are definitely injurious to lepra bacilli, suggesting a deficient or weak cytochrome system. Oxidative capacities of tubercle bacilli and murine lepra bacilli toward carbon dioxide are roughly equal; neither act on glycerine or glucose.

Tubercle bacilli are active in oxygen metabolism through the pyruvate sequence, but murine lepra bacilli are not. John's bacillus has been shown to require a "growth factor," especially for primary isolation. This is doubtful for tubercle bacilli and unknown for lepra bacilli.

Albumin and body fluids have a greater capacity to inhibit the metabolism of murine lepra bacilli than that of tubercle bacilli; for tubercle bacilli, the production of toxic lipids and the inhibition of succinates favor the bacillus vs. cell balance. The metabolic "capacities" of murine lepra bacilli appear to favor their infectiousness for animals.

### Inducing Pathogenesis of *M. leprae* in Animals

WILLIAM H. FELDMAN, D.V.M., *professor of comparative pathology, Mayo Foundation, University of Minnesota Graduate School, Rochester, Minn.*

A method of inoculating animals with *Mycobacterium leprae* obviously would be of value as a means of enlarging understanding of leprosy. Yet, experiences with tuberculosis indicate that duplication of the human disease is not necessarily to be expected. For success, it would appear that the lepra bacillus must survive and reproduce intracellularly. The better known laboratory animals, as well as some others, have

proved refractory to infection, but many available species have not been tried.

The intradermal route of inoculation seems not to have been investigated adequately, Feldman suggested, especially from the standpoint of a medium of relatively low average temperature. There are at least two examples of animal mycobacterial diseases in which skin temperature appears to be a determining factor.

Possible procedures for reducing host resistance include whole-body radiation to reduce properdin levels and the use of hormonal substances or agents adversely affecting animal metabolism. The role of lipids in the lepromatous type of granuloma suggests a field for investigation. Adjuvant substances such as silica might be used in the inoculum.

Suggested animals are the anthropoid apes, hamsters, young swine and calves, and wild rodent species. Marsupials have not been studied adequately, although promising results have been obtained with them in related fields. Experiments of long duration should be planned.

The empirical approach to the problem of inoculating animals is necessary as long as nothing definite is known. To date, this approach has not been subjected to the applications of more than a fraction of the imaginative possibilities.

### Comprehensive Program for Inoculation of Human Leprosy Into Laboratory Animals

CHAPMAN H. BINFORD, M.D., *chief, Laboratory for Leprosy Investigations, Armed Forces Institute of Pathology, Washington, D. C.*

Binford described the cooperative program of the Armed Forces Institute of Pathology and the Public Health Service Communicable Disease Center laboratories which is designed specifically for experimental inoculation of animals with human leprosy. The animals will be inoculated and kept in the CDC laboratories. The histological study of biopsy and autopsy specimens of the inoculated animals will be done at the Armed Forces Institute of Pathology.

Binford elaborated the numerous details which support the thesis that in man the lepra

## **Mycobacteria in Intracellular Environment**

JOHN H. HANKS, Ph.D., *bacteriologist in charge, Leonard Wood Memorial Bacteriology Laboratory, Harvard Medical School, Boston, Mass.*

Metabolic methods of studying mycobacteria, with respect to their behavior during growth, embody two essential features which are quite different from the features of standard bacteriological methods. The first consists of a study of the hydrogen exchange as measured by the quantities of hydrogen liberated when oxygen is excluded from the reaction. Hanks discussed several methods of measuring hydrogen, by means of methylene blue or tetrazolium compounds. In combination with the tetrazolium compounds, the hydrogen produces a variety of colored substances. The second feature consists of study of the oxygen uptake by bacteria in the Warburg apparatus.

Studies by Hanks on the organism of rat leprosy have shown that the fresh suspensions failed to oxidize any one of a large number of test substrates. They have indicated that the substrate is not of particular significance in endogenous metabolism. When the basic substrate is given a yeast supplement, the metabolic effect is enhanced to some degree, but the enhancement is greater when an albumin-yeast complex is provided. Anaerobiasis greatly decreases the metabolic activity of the organism. This capacity of the organism to respire independently of the substrate clearly indicates that in the rat's tissues it is not dependent on cell respiration or intracellular enzyme systems. Although the organism may compete with the cell, it is able to respire or to metabolize independently from the cell.

Hanks discussed the substances present in plasma proteins, particularly with reference to factors that inhibit endogenous metabolic activity. These factors appear to be more effective in relation to the rat leprosy organism than to other mycobacteria. To illustrate, he presented diagrammatic sketches of the metabolism of the murine leprosy organism as affected by various inhibiting factors in plasma proteins. Until metabolic activity of the organism can be shown by metabolic study methods to

gain energy in time, there is no point in employing standard bacteriological methods in leprosy, he concluded.

## **Growth in HeLa Cells of Cultivable Mycobacteria**

CHARLES C. SHEPARD, M.D., *Virus and Rickettsia Laboratory, Communicable Disease Center, Public Health Service, Montgomery, Ala.*

Shepard presented illustrations of his work on growth of tubercle bacilli in tissue cultures, using as his baseline H-37Rv human organisms as grown in the HeLa cell. Horse serum in the medium produces much better entry of organisms into the cell than does human serum. However, once bacilli are admitted to the cell, irrespective of the nature of the process, the organisms grow within the cell much better in the presence of human serum. Bacillary suspensions used were from those grown in Tween media, with their very small individual clumps.

Only doubtful growth can be visualized in 24 hours, but substantial growth is evident in 3 days and excellent growth in 5 days. At 7 days, under favorable conditions, growth begins to expand beyond the cell so that from this time onward intracellular growth is complicated by extracellular growth and by possible cell injury. Shepard showed sections and smears confirming the intracellular site of growth and illustrated the cords and perinuclear chains of growing organisms. He indicated an area near the centrosome of the cell as a particularly favorable site for growth.

Shepard concluded with a presentation of data indicating the usefulness of the tissue culture in the measurement of activity of drugs against mycobacteria.

## **Analysis of Properties of Mycobacteria by Metabolic Study**

CLARKE T. GRAY, Ph.D., *biochemist, Leonard Wood Memorial Bacteriology Laboratory, Harvard Medical School, Boston, Mass.*

Saprophytic acid-fast bacteria metabolize succinates, acetates, and both long- and short-

been used in trying to identify the cultivated organism with that of the disease. Complement fixation tests, flocculation tests, and agglutination tests have been used for diagnostic or prognostic purposes.

The various serologic tests performed at Carville in the past 30 years were reviewed by Sister Hilary Ross. She described in detail the flocculation test devised by Olmos Castro and discussed its possible value as a routine laboratory method in the detection of overlooked cases of lepromatous leprosy in endemic areas. Also of possible value in leprosy is Middlebrook's hemagglutination test. A proposed study designed to detect specific antibodies in leprosy serum was outlined.

### Induction of Reactivity to Lepromin by BCG Vaccine

JAMES A. DOULL, M.D., *medical director, Leonard Wood Memorial, Washington, D. C.*

In a carefully controlled study in the Philippines, Guinto, Doull, and Mabalay found that in 71.2 percent of previously negative children, the lepromin (Mitsuda) reaction had become positive 90 days after BCG vaccination. In control groups given saline or diphtheria toxoid, the proportion becoming lepromin positive was 27.1 percent, a finding that is attributed to natural (unknown) causes or the lepromin test itself, or to both.

By the device of leaving a sample of the originally selected children untested at the outset and unvaccinated, it was possible to compare the final lepromin status of three comparable groups: (1) children given BCG and an initial lepromin test, (2) children given saline or toxoid and an initial lepromin test, and (3) the basic controls. From comparisons of these groups, it was estimated that the proportion of all children who had become lepromin positive because of BCG was only 33.4 percent, because of the lepromin test, 7.2 percent, and because of natural causes, 11.5 percent.

Natural acquirement of reactivity is of great interest. It is too frequent to be accounted for by exposure to leprosy. It can hardly be caused by exposure to tuberculosis because only

2.3 percent of these children reacted to tuberculin (5 T.U. of PPD-S) at the outset as compared to 23.2 percent that showed reactivity of the Mitsuda type.

### The Marianum Antigen in Leprosy

ROLLA R. WOLCOTT, M.D., *clinical director, Public Health Service Hospital, Carville, La.*

Wolcott presented three of a number of patients who were receiving monthly intradermal injections of a killed culture of a mycobacterium (called *Mycobacterium marianum*) isolated from a leprous nodule by Sister Marie Suzanne of Lyons, France. In all these patients, prolonged sulfone treatment had failed. Some local reactions to the antigen had occurred, indicating some type of activity on the part of the vaccine, but it was too early to say whether the vaccine was beneficial. No biopsies of the reactive lesions had as yet been made. The antigen was being used as a supplement to sulfone or other therapy.

### Protein Patterns in Leprosy

RUDOLPH J. MUELLING, Jr., M.D., *associate pathologist, Charity Hospital, New Orleans, La.*

Chemical fractionation and paper electrophoresis studies by Muelling of serum protein in patients with leprosy gave the following results.

Active: 98 patients. The total globulin was usually elevated. The total protein level depended on the level of the serum albumin. The most common globulin aberration was a single clear elevation of the gamma globulin. A two-fraction elevation of the beta and gamma fractions came next, followed by a generalized increase in globulin with a predominant rise in gamma globulin. The lipoprotein was not remarkable. Fifty-five of the patients showed peaking elevation of the mucopolysaccharide. This fraction seems to be related to activity of the disease.

Amyloid: 15 patients. The total protein was elevated or not, depending on the level of albumin. As the albumin disappeared, there was an increasing curve reversal. There was more

bacillus has a natural preference for sites of lower body temperatures, and he expanded upon methods of applying this temperature selection to animal experimentation, using the most superficial inoculations practical and attempting to lower skin temperatures by frequent clipping of the fur of the animals. Mice of a hairless strain will also be used. Since in man the lepra bacillus has a predilection for peripheral nerves, intraneural inoculation will be tried.

For use in this animal inoculation program, human leprosy tissue frozen in solid carbon dioxide has been obtained from untreated patients in the Philippines and shipped by air to Washington. This was made possible by the cooperation of leprologists of the Philippine Government and the Leonard Wood Memorial and pathologists of the United States Air Force and United States Army in the Philippines and in Tokyo.

### **Possible Approaches to a Study of Antibody Responses in Leprosy**

DONALD S. MARTIN, M.D., *chief, Bacteriology Section, Communicable Disease Center, Public Health Service, Chamblee, Ga.*

According to Martin, questions of serology in leprosy cannot be advanced far until bona fide cultures of the organism are available. In submitting a number of suggested procedures, he recommended study of the many variations in a few carefully selected patients. His discussion dealt primarily with possible applications in leprosy of the more recently developed serologic techniques, such as the Middlebrook-Dubos hemagglutination technique, which measures the specific anticarbohydrate titers. As in blastomycosis, there could be a relation in leprosy between protein antibodies and prognosis. Studies to separate the different protein and carbohydrate antigens and their antibodies could be approached, albeit only indirectly until cultures are available.

Methods of study potentially available include using precipitin bands in gels, tannic-acid-coated cells, and electrophoretic potentials of the reacting areas.

### **Possible Uses of the Properdin System in Studying Immunity and Bacteriology**

JACK W. MILLAR, *Lt. Comdr., MC., USN, commanding officer, Naval Medical Research Unit No. 1, University of California, Berkeley, Calif.*

Approaches to the study of properdins in leprosy, both as they occur in the patient and as they might be activated or inactivated to alter infectivity of leprosy for animals, were discussed by Millar.

Briefly, properdin is a normal serum constituent, differing from antibody—a euglobulin activated by complement and magnesium. It kills or inactivates certain bacteria, lyses red cells, and combines chemically and reversibly with a yeast-carbohydrate complex (zymosan), from which compound it can be isolated. Properdin activity can be blocked temporarily in vivo by certain compounds, many of which occur in bacterial cell walls. Properdin is lowered by radiation.

### **Separation of Leprosy Organisms From Tissues**

HOWARD J. HENDERSON, *research associate, Henry Phipps Institute, Philadelphia, Pa.*

Henderson proposes to separate the lepra protein antigens from suspensions of tissues rich in leprosy organisms, by homogenizing the tissue, overlaying the suspension with oil, and collecting the acid-fast material, by centrifuge, at the oil-water interface. Preliminary work was done by Henderson nearly two decades ago. He believes that, granting an adequate supply of material, this method will yield sufficiently concentrated bacilli to enable chemical studies of their protein moiety, lipoprotein moieties, and others. Various techniques have become available since his earlier studies.

### **Studies in Serology**

SISTER HILARY ROSS, *biochemist, Public Health Service Hospital, Carville, La.*

Serologic studies in leprosy have had different objectives. Complement fixation tests have

that murine leprosy gives a spectrum closer to human leprosy than does murine tuberculosis.

Some variation in duration of experiments and drug withdrawals have been studied in relation to drug effectivities.

## Epidemiology of Leprosy in Louisiana

L. F. BADGER, M.D., *chief, Leprosy Control Unit, Communicable Disease Center, Public Health Service, Atlanta, Ga.*

On the basis of an epidemiological study of leprosy, especially as seen in Louisiana, Badger stressed the following points:

1. The ideas that the disease is feebly contagious and that prolonged exposure is necessary are not supportable. The figures show that infections in children have been overemphasized; a good many occur after exposure in adult life. The sex incidence seems of relatively little or no significance.

2. The source of infection is more frequently outside the family than within.

3. Early recognition and early treatment are essential to control. Extensive case finding, in contrast to casual discovery of new cases, must be undertaken.

4. There is no basis for assuming that the disease could not appear and spread through other parts of the United States.

## Leprosy Control in Louisiana

WILLIAM H. MEYER, M.D., *leprologist, Louisiana State Department of Health, New Orleans, La.*

Leprosy may have been introduced into Louisiana by slaves brought into the colony between 1719 and 1732. Or it may have been introduced from the earlier Spanish colonies in Mexico and elsewhere, as it is known that leprosy existed in those colonies in early days.

The first recorded control effort was the establishment by the Spanish governor Ulloa of an isolation area for persons with leprosy at Bolize in 1766. Historical records show also that from 1785 to 1807 there was a leprosy hospital near New Orleans, but from 1807 to 1880 nothing seems to have been done. In 1894 the State established a hospital for leprosy patients

and in 1921, gave it to the Federal Government.

Current control efforts include visits to the patient's home by the physician to obtain information concerning possible sources and new cases of the disease.

There has been a steady decrease in admissions from Louisiana to the leprosy hospital at Carville. An estimated one-third or more of the AWOL cases from Carville reside within the State.

## The Risk of Contracting Leprosy in the Household

FRED C. KLUTH, M.D., *Leonard Wood Memorial associate epidemiologist, Texas State Department of Health, Corpus Christi-Nueces County Health Unit, Corpus Christi, Tex.*

Among 456 household contacts of lepromatous leprosy patients in Texas, 12 new cases of leprosy (2.7 percent) were discovered. Nine others were suspected but unproved; some of these were in older individuals and were possibly inactive. In 78 nonhousehold contacts, 2 cases were discovered. In 112 contacts with cases of tuberculoid leprosy, leprosy was suspected in 1 and definite in 1.

In agreement with Meyer, Kluth emphasized the need for quiet and unheralded operation of contact investigation, with minimization of the "official" character of home visits, even to the point of mild deception of the patient's neighbors.

The number of new cases of leprosy in Texas each year remains about stationary. In 1955, there were 24, all from the usual foci. The average age of onset is surprisingly high, over 30 years.

## Clinical Evaluation Studies of Drugs

JAMES A. DOULL, M.D., *medical director, Leonard Wood Memorial, Washington, D. C.*

Clinical evaluation studies of drugs in leprosy have been conducted by the Leonard Wood Memorial during the past 4 years in widely separated institutions in Japan, South Africa, and the Philippines. Results from the different institutions are similar.

single-fraction elevation than double-fraction; if there was a general increase, it was overwhelming.

**Tubercloid:** 17 patients. The albumin was usually normal. The total protein varied between 7.3 and 10.4 grams percent. The beta globulin was usually increased over gamma globulin. Alpha elevation was rare. The mucopolysaccharide was usually not elevated (11 patients out of 17); when increased, the increase was usually the type produced by a general infection. The lipoprotein was usually increased, probably because of the beta globulin increase.

**Inactive:** 30 patients. Two out of the 30 had elevated mucopolysaccharides.

Muelling offered suggestions for further investigations, particularly of the idea that the mucopolysaccharide levels are related to activity of the disease. Dr. Catherine Goetz and Sister Hilary Ross participated in the studies.

## Histopathology and Leprosy

GEORGE L. FITE, M.D., *Laboratory of Pathology and Histology, National Institute of Arthritis and Metabolic Diseases, Public Health Service, Bethesda, Md.*

Fite posed the question: How does the accumulated knowledge of anatomic leprosy suggest or indicate lines for further inquiry? He declared that any consideration of advanced leprosy anatomically is ridiculous, as compared with the need for knowledge of the early phases. Classifications of leprosy are of themselves worthless. They are of value only in indicating where to look for the factors that determine whether a patient, including the "no leprosy at all type," has this or that type of leprosy.

Although studies of terminal nerves and nerve endings in early leprosy might yield a clue to a finite mechanism, it would be the mechanism that was important, not the nerve-ending involvement of itself. Fite discussed the realms in which the determinant factors might lie, indicating that none of them involved a primary histological study.

The epidemiologist has learned that the study of the epidemiology of the lepromatous disease alone is almost valueless. The serologist might profit by the lesson: The place to search for

serum antibodies may not be the person with the disease, but the exposed individual without the disease.

## Amyloidosis in Leprosy: Observations in Pathology

LAWRENCE L. SWAN, M.D., *Lafayette Medical Laboratory, Lafayette, La. (formerly, chief of pathology, Public Health Service Hospitals, New Orleans, and Carville, La.)*

In 50 consecutive autopsied cases of leprosy, amyloid disease was the definite cause of death in nearly 40 percent, and was present in more than 46 percent. Figures available indicate that amyloidosis is not as important in leprosy in other countries, but the subject is not well studied. The disease, which is associated with abnormalities in the serum globulin, is still difficult to identify during life.

At Carville, amyloidosis has occurred in cases without such complications as tuberculosis, throat complication, syphilis, or chronic ulcerations, showing that leprosy of itself is factorial.

## Chemotherapy of Murine Leprosy

Y. T. CHANG, M. D., *Leonard Wood Memorial fellow in pharmacology, National Institute of Arthritis and Metabolic Diseases, Public Health Service.*

Chang presented a review of the work on chemotherapy in murine leprosy. Mice are used as the experimental animals, and measurement of intraperitoneal lesions following intraperitoneal injections is used as the criterion. Test experiments require 3 months. This test, according to Chang, is as sensitive as similar tests for in vivo activity against tuberculosis.

Thirteen compounds have been tested: streptomycin, chlortetracycline, oxytetracycline, chloramphenicol, erythromycin, nicotinamide, pyrazinamide, para-aminosalicylic acid, amithiozone, isoniazid, B-283, diphenylthioureas, and sulfones. Only five of these, streptomycin, nicotinamide, pyrazinamide, isoniazid, and diaminodiphenyl-sulfone, were found active. Recently, cycloserine has also proved effective. Comparison of the various effectivities indicates

FRANK E. LUNDIN, Jr., M.D., *Public Health Service Hospital, Carville, La.*

Lundin reported briefly on clinico-pathological examinations of electrolytes in leprosy, BSP tests, and cold precipitable lipoproteins. In determinations of magnesium, calcium, phosphorus, and potassium, many serums gave results below the control range. Sodium and chloride showed a few serums above the range for normals. In six of the BSP tests, there was abnormal positive retention for which there was no explanation. Five of 144 patients showed protein precipitates in serums refrigerated for 24 hours. The precipitates redissolved

on warming and were shown by electrophoresis studies to be lipoproteins.

### Treatment of Ocular Complications

STEPHEN J. HERBERT, M.D., *Public Health Service Hospital, Carville, La.*

Eye complications in leprosy, in particular improvements in treatments of oculomotor nerve residuals and the problems of treatment of keratitis, lid reconstructions, and the like, were reviewed by Herbert. Misconception and mistreatment of the secondary glaucomas have followed acute attacks of iridocyclitis in leprosy in the past.

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### Grants-in-Aid for Training in Air Pollution Control

Grants-in-aid for graduate training in air pollution prevention and abatement are now available from the Public Health Service.

Designed to increase the number, competence, and knowledge of professional personnel engaged in community air pollution control work, the grants-in-aid will be awarded to three groups: State and local air pollution control agencies or other public agencies for training their personnel, educational institutions for assistance in developing and supporting new courses, and individuals for specialized training in air pollution.

In awarding the grants, the Public Health Service will consider such factors as severity of the air pollution problem, appropriateness of the proposed course, and qualifications of the prospective trainee. Grants to public agencies and individuals will cover tuition and fees, travel expenses, and subsistence allowances or stipends. Those to educational institutions may be used to pay all necessary expenses connected with a course, including salaries of instructors. Grants will be limited to 12-month periods, but in most instances they may be renewed for additional periods.

Those interested in training during the 1956-57 academic year should apply as soon as possible. For each academic year thereafter, applications should be submitted by April 1 of the preceding academic year. However, grants will be awarded as vacancies occur, and applications may be submitted at any time.

Additional information and application forms may be obtained from the regional offices of the Public Health Service or from the Chief, Division of General Health Services, Bureau of State Services, Public Health Service, Washington 25, D. C.

The first series, with 852 patients, proved too complicated to be completely satisfactory. Five drugs or drug combinations and one placebo were used. Diasone, diaminodiphenyl-sulfone, and streptomycin proved equally effective. There was no advantage in the combined drugs and no effective bacteriological improvement.

A second series of 499 patients gave equal results with diasone, isoniazid plus diasone, dihydrostreptomycin, isoniazid and streptomycin.

In a third series now in progress, BCG vaccination in combination with drug treatment is being studied.

Additional pilot studies in the Philippines are designed to examine isoniazid, thiosemicarbazone, pyrazinamide, cycloserine, and combinations of these. Thus far, none of the hepatitis and convulsive complications have been met.

The first series, according to Doull, provided the first statistical evidence of the value of the sulfones in treating leprosy. Such evidence is absent in many of the reports of drug treatments.

### Seromycin Trials in Leprosy

FRANK E. LUNDIN, Jr., M.D., *Public Health Service Hospital, Carville, La.*

Lundin reported the results of experimental treatment of 10 patients with seromycin. The dosage was 250 mg. every 12 hours. Treatment in two patients was discontinued because of complications. Five patients received sulfones in addition to seromycin. No bacteriological improvement has been recorded. Although there was probably some improvement, it was no greater than might be recorded from sulfone treatment alone.

### Hemoglobin Types in Leprosy

HORATIO C. WOOD IV, M.D., *Public Health Service Hospital, Carville, La.*

In studies at Carville on the distributions of various genetically determined types of hemo-

globin, no differences were observed between the leprosy patients and normal populations.

### Orthopedic Procedures in Leprosy

DANIEL C. RIORDAN, M.D., *division of orthopedics, Tulane University School of Medicine, New Orleans, La.*

Orthopedic procedures used for the prevention and alleviation of deformities resulting from leprosy were described by Riordan. He mentioned in particular ulnar nerve transplantations from the superficial site to a deeper site, in order to prevent trauma to the nerve, and opening of the nerve sheath in older cases, which often gives immediate relief of nerve pain.

Other reconstructive procedures used are:

1. Shoe corrections, drop-foot braces, and splinting to prevent hand deformities.

2. Toe and metatarsal amputations, removal of ulcers plus underlying bones, joint fusions of hand joints plus bone shortenings, fixations in half-grasp positions in severe cases, and tendon transfers.

### Limitations of Sulfone Therapy

ROLLA R. WOLCOTT, M.D., *clinical director, Public Health Service Hospital, Carville, La.*

Reviewing the story of the introduction and spread of sulfone treatment, Wolcott emphasized that the sulfones have their limitations. He concurred in Doull's remark that statistical studies clearly indicate the need for a more effective drug. According to a "probability of arrest" chart, a patient with lepromatous leprosy has a 40 percent chance of arrest of the disease after 8 years of steady sulfone treatment. This is not a good probability for an 8-year course of treatment. However, many other benefits accrue from the sulfones, especially in prevention of complications. Tracheotomies, once steadily performed, are not required; there is far less need for minor amputations, and almost certainly life expectancy is improved.



given way to the "nuclear" family of parents and minor children, who live apart from other kin and keep in touch largely through Christmas cards and occasional visits. As children mature, they leave the parental home to form separate nuclear families of their own, in a continual fragmenting process.

*Today's family is mobile.*

In this moving van era, a high proportion of families pick up and move to a new community, away from former friends and relatives, to take advantage of new job opportunities.

*Dependent aged parents are now less likely to be supported by their grown children.*

Rejection or isolation of the aged, linked in part to the modern family structure and functions (3), has contributed to a major health problem. Many of the ills of the aged (for example, much of the so-called senile dementia) flow not only from organic aging but also from roles of social isolation dictated by family, cultural, and economic rejection (4a). From a public health viewpoint, it is important to investigate the ways in which the changing family, among other forces in the social environment, has affected the aged.

*The production of most goods and services has passed from the home to the factory and to service industries.*

In 1949 for the first time the number of wives employed outside the home exceeded the number of employed single women. Women in the home perform fewer economic functions: They no longer preserve great quantities of food, make the family's clothing, or cultivate large gardens (5). The typical family of a century ago was rural and a major productive unit. Wives were valued in proportion to their economic contribution, which in large part determined the family's status. Children were valued as producers. The change in the family as an economic team, today less frequently operating a farm or family business, is widely believed to be a contributing factor to its shrinkage in size and its relative instability. For the most part, only outside wage earners now make a direct contribution to the family's income although wives and children still may perform economic services at home.

*The family's formal control over the decisions of its members is much less than in past years.*

The patriarchal figure, except in a few subcultures, has receded into myth; nowadays, grown children tend independently to choose careers, mates, and neighborhoods. Much of the family's former recreational, protective, and related functions have been transferred to community agencies, or they are purchased as services. Not all families and not all members of the family accept the changes equally or necessarily integrate them into their attitudes and emotions. Emotional conflict or deprivation often accompanies such a transformation, with implications for individual and public health.

*The divorce rate, though down somewhat from its prewar peak, is relatively high as compared with levels of 1850 or 1900.*

The future divorce rate will be affected by probable continuation of past changes in the family which have tended to weaken its stability (6a). Most of the evidence suggests that divorce is relatively more frequent in families with fewer children although we do not know to what extent children are a deterrent to divorce (7). (The past and present extent of desertions—the "poor man's divorce"—is unknown.) With the decline of the extended family and the anonymity of the urban family, particularly in a new community, there is less pressure by relatives and friends to keep the family together. The reduction of the family's economic functions diminishes the material dependence of the marriage partners on each other.

### The Irreducible Functions

In view of the major changes and loss of functions, does the family still serve purposes of sufficient importance to assure its survival? The available data, fragmentary as they are, leave no doubt as to the affirmative answer. Marriage is more popular in the United States than ever: People now marry at a considerably younger age than, for example, in 1890; a much larger proportion of men and women are married today than two generations ago, and, though divorce rates are high, the remarriage rate is also high.

For the family to lose many of its traditional functions but still to become personally important to more people than ever before would

# Public Health Begins in the Family

By HALBERT L. DUNN, M.D., and MORT GILBERT

THE FAMILY, as the most important institution in society (1), is intensively studied by sociologists and anthropologists. It is seldom studied by public health agencies, and it is almost entirely outside the current framework of vital and health statistics.

Births, deaths, diseases, marriages, and divorces are generally reported as events occurring to individuals. Our routine statistics tell us next to nothing about the family setting or family situation of these individuals or about the role of the family in health and disease. Although information of this type is admittedly difficult and perhaps impossible to derive from routine records, it is quite feasible to collect routine data on the "universe" of American families. The factual background would provide a base for specialized sample studies.

In this paper we will suggest, on the basis of existing statistical mechanisms, some of the ways in which public health agencies might proceed to collect usable data on families as well as on individuals. This of course raises a larger question, which we will attempt to explore first: What does the family have to do with public health?

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*Dr. Dunn is chief of the National Office of Vital Statistics, Public Health Service, and Mr. Gilbert is publications officer. Dr. Dunn presented a slightly longer version of their paper at the meeting of the Southern Branch of the American Public Health Association at Tulsa, Okla., April 4-6, 1956. Other reports on the family-centered approach to public health are presented on pp. 1011-1031.*

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With some 40 million families in this country—the number depends on how family is defined—most of us have firsthand knowledge of only a few. Nearly everybody defines the family differently and holds strong, individual opinions on its character. High divorce rates, dispersion and mobility of families, changes in moral codes and in occupation patterns, and, until the 1940's, falling birth rates had convinced many that the family as an institution was crumbling. The consensus of modern studies is that the family is going through a profound transition but that it shows no signs of leaving the social scene.

## Over the Past Century

To gain perspective on the structure and functions of today's family, it may be helpful to compare it with the American family of a century ago. Ignoring cultural variations and concentrating on the typical American family, we have surveyed the extensive literature of family sociology, starting with Ogburn's classic analysis, "The Family and Its Functions" (2), and including many of the more recent works. Although interpretations and emphases are controversial because nearly all aspects of the family need more intensive research, most students of the family appear to agree that the following changes and effects between 1850 and 1950 have been significant.

*The family has shrunk in size.*

Today's typical family has fewer children and is limited to two generations, parents and minor children. What sociologists call the "extended family"—several generations living near together and bound by close ties—has

the place to catalog child ailments that have their principal genesis in family maladjustments. A vast literature of psychopathology deals with the pathetic results of parental overprotection or rejection; of prolonged mother-child separation; of hostile, overpunishing, or hypercritical parents; of abnormal sibling rivalry; of homes with continuous tension and discord; and sometimes of homes broken by divorce, desertion, or death. Public health is interested in the family if for no other reason than to investigate the etiology and prevention of a wide range of childhood ills.

Though the American family today is most likely to be small and urban, the dominant ideal still clings to rural ways and large kinship. The American family concept has never adjusted to the facts of city life. Many people have not yet learned to live in the modern family, and this lag has contributed to family ill health. In the small, isolated family unit, every relationship is intensified and more continuous (14). A child slighted by his mother cannot seek or expect comfort from his aunt if the aunt lives in another city. Bossard makes this point (15):

"It is the consensus that many Americans suffer from a sense of insecurity, and there can be little doubt that this is in part a heritage of the immediate family form. The very size of the family unit is important to the child in this respect for the same reason that the size of the ledge from which we view the precipice below affects our sense of security. The American child who lives and matures in a father-mother-child family unit stands on a very narrow family platform, even if it is in no way imperiled. To this is added the constant danger for the child that the few persons he must rely on may falter or fail."

Despite vast clinical experience with psychosomatic illness, despite millions of hours devoted to the recall of childhood traumas, there still is no agreement on the role of childhood experience in the development of health or sickness in adults. Many cases of the so-called "maladaptive reactions" of adults—the chronic fatigue or neurasthenic syndromes, the organ neuroses such as peptic ulcer and colitis, the disabling hysterias, the anxiety disorders, and the other psychophysiological ills—have been

traced (to the satisfaction of most psychiatrists and clinical psychologists) to inappropriate patterns learned too rigidly in childhood (16-18). Wartime evidence indicated that even the strong personality has a breaking point under sufficient traumatic stress; psychological disorder in adults does not necessarily stem from childhood maladjustment (19). Though the evidence is mixed, the family of childhood undoubtedly affects adaptations to stress in adult life. Whether we habitually react to stress or frustration by withdrawal, aggression, escape in fantasy or functional illness is often a reflection or continuation of fundamental patterns acquired in early life.

### The Adult Personality

Emotional security in our culture is based mainly on assurances of affection and intimate companionship with other individuals. Human nature has a basic need for favorable emotional response from others (11b). No one outgrows it, and most suffer unhappiness and psychic, even physical, ills without it. This brings us to the other major function of the family: the stabilization of the adult personality.

The individual in an urbanized culture is often isolated and largely anonymous. He may be separated from kin and from most of his old, intimate friends. He makes new friends but in relatively formal relationships. Winch refers to the prevalent feeling of loneliness, to "the separation anxiety" that is apparently characteristic of today's society (20). For many individuals, the family has survived as the only remaining primary group, which Murphy defines as "the face-to-face world, the world of tenderness and immediacy, the world of security" (4c). Except for the family, our lives are now spent mostly in secondary groups—with associates on the job, in trade union or professional meetings, in fraternal or political organizations. We use these for many purposes, but they cannot meet our deep-seated need for love and emotional security. In this respect the family has become much more significant, and this is perhaps an important reason for its persistent strength.

Shurtleff has pointed to associations between marital status and mortality (21, 22). Taking

seem to present a paradox. Parsons and Bales (8a) in a recent study of family structure in the light of group interaction theory, resolve it this way:

"The family has become a *more specialized agency than before*, probably more specialized than it has been in any previously known society. This represents a decline of *certain* features which traditionally have been associated with families; but whether it represents a 'decline of the family' in a more general sense is another matter; we think not. . . . The family is not in any general sense less important, because the society is dependent *more* exclusively on it for the performance of *certain* of its vital functions."

These remaining vital functions include the rearing of children and the stabilization of the adult personality. Each is basic and irreducible, and in our culture it is difficult to imagine how they could be transferred to any other agency. Since the family is indispensable for bringing up the child and providing an emotional setting for most adult personalities, its optimum performance could avert many of the strains and maladjustments that now require pediatric, general medical, and psychiatric service.

### The Rearing of Children

The newborn infant is without language, habits, customs, moral values, skills, or differentiated patterns of emotional expectation and response (9, 10). It is the family's function, particularly during infancy and the 6 early "golden years" of personality development, to transform the child into a social creature who is at home in the culture, and who carries and acts out the culture patterns without undue strain. The family has been variously called the cradle of the personality, the nursery of human nature, the porous buffer that lets the child meet experience as he can assimilate it, and that protects him from parts of the environment damaging to him if encountered too soon (4b).

It is in the family that the child acquires the basic patterns of living—everything from table manners to ethical values. He learns to look for certain types of emotional response from others,

to strive for various types of approved experience, to avoid experience that brings him pain and disapproval. Interacting with his family, learning how to win acceptance and avoid rejection in this small world, he forms behavior patterns, attitudes, and even deep-seated emotional reactions that will profoundly affect his character and personality throughout life.

The family experience begins to provide the child with a usable set of responses, attitudes, and habits that will later enable him to function as an independent adult in society. Without this foundation, human behavior would be totally unpredictable, and even an uncomplicated social structure would be unworkable (11a). But the family, in its infinite variety, does more than this. No child-rearing family is society in miniature, but a unique group that is easy to differentiate from any other group.

Children in a family setting acquire not only the generalized patterns of the culture but also a unique interpretation of the parents' subculture. Although all children of the same generation in a society develop much the same kind of human nature, each child is somewhat different from the products of other families. Thus the role of the family is not only to nurture a new generation that fits into the society but also to provide the great variety of personalities that society needs (8b).

Infants and small children in order to thrive apparently need personal, adult response over and above the satisfaction of hunger and other physiological needs. The high death rate that prevailed in even the most sanitary foundling institutions and the host of studies demonstrating damage in institutionalized children are often cited as evidence of the child's need for personal attention (12). This is a principal reason that foundlings and young orphans are placed in foster families as quickly as possible: Even a poor family generally does better by the child than a scientific regimen without personal interest.

But, as the psychologist John Dollard has remarked, "domestication" of the child "is without exception a process attended by conflict and strain" (13). Though the family is the best source of healthy, well-adjusted children, it is also the source of cases that crowd outpatient and child guidance clinics. This is not

medical practice has recovered much of its former prestige, and public health has broadened its interest to include the chronic diseases and their long-term effects on individuals.

But, despite progress, the family often remains in a medical vacuum, largely outside the scope of private medicine and nearly neglected by public health. We say "nearly" because one public health practitioner, the public health nurse, has always focused her attention on the family unit. It has been obvious to her, as to the family caseworker in social service agencies, that health or illness or recovery occurs in a family context.

The public health nurse always has taken stock of the unique family situation, of the family's income and education. Her methods have been mostly rule of thumb, based on the impressionistic data of her own experience. Lack of reliable baseline data on the family as a unit in health and disease has not prevented her from doing an effective job, just as the lack of mortality and morbidity data did not prevent effective work by the physician and the health officer 50 years ago.

But if the needed family data were available, the nurse and every other member of the health professions would learn to use the material, and come to rely on it as much as on our highly developed mortality data. None of us works in the dark by choice. Public health workers along with sociologists, demographers, family service workers, family counselors, child psychologists, psychiatric specialists, and business and market analysts would profit from real knowledge of the "universe" of American families: the norms and the ranges, the averages and the anomalies, and the interrelation of disease with varying families and family situations. Eventually public health, drawing on both the science of medicine and the methods of family casework, must develop an epidemiology of family disorders and diseases. Classical epidemiology knows how to deal with the spread of infectious disease in families, but for lack of technique and data it shies away from explaining why several members of a family develop the same gastrointestinal dysfunction or similar neurotic cardiac complaints. The wide spectrum of public health includes not only tuberculosis, poliomyelitis, and other infectious diseases that are routinely studied and attacked in

the family context but also many noninfectious ailments such as obesity, alcoholism, asthma, and essential hypertension, all of which are influenced usually by the family situation.

Although many types of illness have little or no connection with the family situation, "illness is one form of family maladjustment" (29a). This observation was made by Henry B. Richardson, a doctor of internal medicine who collaborated with associates in psychiatry, public health nursing, and social service, in a pioneering study of the family as the unit of illness. After several years spent in establishing the direct connection of disease with specific family situations, Richardson wrote (29b):

"The individual is a part of the family, in illness as well as in health . . . The idea of disease as an entity which is limited to one person . . . fades into the background, and disease becomes an integral part of the continuous process of living. The family is the unit of illness, because it is the unit of living."

#### Sources of Family Data

How do we begin to build up the family data that public health officials can apply?

An immediate, basic task of public health agencies is to improve the reporting of information contained on marriage and divorce certificates. Marriage and divorce are major punctuation marks in family history, as are birth and death. All these events change the characteristics of the population and of the family units within the population. They interrelate with a variety of other material from the decennial census and the current population surveys of the Bureau of the Census and from the special surveys of Federal and State agencies. This material as a whole makes up the benchmark statistics that describe the American family as an institution and as a process. Consumers of marriage and divorce statistics want facts on the formation of new families, on their growth and composition, and on their dissolution. Marriage and divorce statistics are part of family statistics.

The collection of marriage and divorce statistics is a function of the public health agency in most States and in the Federal Government. Generally, it is among the less emphasized functions.

the 1949-51 death rates of married men as equal to the index 100, Shurtleff found that the age-adjusted rate for single men was 163. For widowers it was 185, and for divorced men 207—more than twice as high as for married men. For women, the comparable index figures were: married women, 100; single women, 124; widows, 155; and divorcees, 155.

The figures themselves do not indicate whether marriage keeps people well or whether people who are well tend to marry and stay married. But various students of divorce, particularly the late sociologist Willard Waller, have likened the traumatic effects of separation to those of bereavement. They speak of the "terrific ego shock," the often "shattering" and "calamitous" effect of divorce on the personality, and point to the frequency of depression and occasionally suicide in the series of divorces that have been investigated (6b). Some recent studies suggest that the long-term personal disorganization that often followed divorce in the past is now on the decrease, perhaps because divorce has become socially more acceptable. But divorce, desertion, and bereavement are still major social forces with health aspects that deserve study and perhaps action programs.

The nature of marriage in our culture warrants study of its implications for public health. When the nuclear family is the only continuous intimate association, the partners expect more of each other in emotional response. This is one example of potential stress in an age of transition, characterized according to Kirkpatrick, "by confusion as to the family tradition." He continues: "Tangled ideologies produce family dramas for which the script and roles are not clearly defined. It is no wonder that family tragedies are enacted and that family members suffer confusion, anxiety, and unhappiness" (23a). Research studies of marital stress are inconclusive, but they indicate that a substantial proportion of husbands and wives are tense and unhappy in their marriage. Weiss and English, whose monumental survey of psychosomatic medicine includes a wide range of family-related illness, noted that "the advice to marry and have children has been a frequent prescription for certain ailments. But, paradoxical though it may seem, many illnesses

arise from the marriage situation, and this fact has not been so clearly appreciated" (24).

In two recent population studies in New York City and a rural part of New York State, and in a study of routine admissions to the surgical service of Cincinnati General Hospital, about half of the people examined in each sample showed moderate to severe neurosis (25). Many outpatient clinics and private physicians report that from half to three-quarters of their patients have symptoms primarily nonorganic in origin or have organic pathology which is aggravated by emotional disorder (26, 27).

These studies are cited not to suggest that any known proportion of this well of human misery originates in the family spring but rather to emphasize the need to explore the major human interrelationships that may bear on public health. One of these, though certainly not the only one, is the family situation. As Kirkpatrick says, "The family is the setting for the most intense emotional experiences which the individual has in the course of a lifetime. Birth, puberty, marriage, and death are family experiences. The family is the source of serene security, of anguished insecurity, of love and hate, of pride and shame, of ecstasy and anguish" (23b). It is small wonder that the family dramas and crises have a profound effect on the course of health and disease.

### Illness and the Family Unit

Fifty years ago the family was the center of medical practice, as suggested in the old, revealing term, family practitioner. Before the era of specialization, the family doctor had a more intimate knowledge of all the family members, of their incomes and ambitions, of the subtle ways in which each reacted to the other. In treating each of his families, he could call on a store of firsthand social, economic, and cultural data, mostly unrecorded on the medical history, and apply this knowledge both to diagnosis and therapy. With the advance of medical science, the family doctor gave way to the specialist who rarely or never saw the patient in a family setting (28). Public health was devoted to preventing disease in the community at large, particularly through sanitary control of water, milk, and insects. In recent years, general

lating the events to the family might be introduced as record items? Would it be valuable to know in what kinds of families deaths from various causes are occurring? Do we want information about successive deaths in families and the composition of the family remnants? What could be done to improve fertility data and child statistics in general through a family-centered approach to the birth certificate? In all of this, the vital statistics system would need the thinking and consultation of health program people at the planning stage.

2. What types of special studies and surveys should be undertaken to enlarge our statistical knowledge of the family in health and disease and to enrich the developing core of vital and health statistics relating to the family? In addition to cross-section studies of family-centered records, we should investigate the feasibility of cohort studies for followup of marriage records and follow-back from divorce records. Moreover, a variety of surveys undertaken for health purposes could be made more valuable if family aspects were considered at the planning stage and incorporated in the study plan. The vital records, perhaps with additional items agreed to by the selected area, might serve as anchor points for such studies.

An urgent research problem is to learn how best to classify families, to determine by limited, short-term studies the kinds of information most essential for characterizing families. Such studies would provide the basis for the collection of family-characterizing data on a larger or a national scale. Without this basic knowledge of the "universe" of American families, the usual study of disease behavior in a selected sample of families cannot be generalized to any known population since there is no way to tell what part of the population the sample represents.

3. In addition to the decennial census, which has always been a rich source of data to students of the family, the current population surveys of the Bureau of the Census are open to special questions on marriage, divorce, and the family structure. They have been used several times for this purpose in the recent past. Questions relating health to the family situation in selected samples could be answered quickly and economically by this means.

4. Hospital and clinic records not only should include questions on the family medical history, as many do at present, but the records for all members of the family might be more accessible as a unit. Exploration of the objectives and technical problems might well be undertaken jointly by vital statistics people and medical record librarians.

5. Similar potentials exist in public health nursing records, which routinely contain data on the family, and which for special study purposes might profitably be collated with birth, death, and marriage records.

From a public health standpoint, the family is not just a social unit, it is an epidemiological unit. Study of the family requires an interdisciplinary approach of classical epidemiology and the social sciences. The statistical technique, for want of a short and simple term, might be called "social biostatistics," to which family-oriented vital statistics would contribute a share of the basic data.

A final quotation from Richardson is appropriate (29c):

"... we may now consider how to develop a science of the family. The language in which this science will be expressed will not have the precision of mathematical analysis, unless on a statistical basis. Much of the material, as in many of the natural sciences and in psychology, will remain on a descriptive level. Nevertheless we may hope to develop an understanding of the family unit, which will help us to predict the future course of events."

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Although some health departments have worked vigorously to improve marriage and divorce reporting, the system on a nationwide basis is relatively primitive and compares unfavorably with that of most other countries of the western world.

No data at all are collected from a substantial number of registration areas in this country; marriage and divorce numbers and rates must therefore be estimated. One of the potential sources of error in these estimates is that in many areas marriage licenses are reported, but marriages are not; the proportion of unused licenses is a fluctuating variable. To take advantage of State differences in legal requirements for marriage and divorce, large numbers of people cross State lines; since reports do not distinguish between temporary and actual residence, the true marriage and divorce rates for any State's residents cannot be determined.

Because certificate information varies from State to State, national cross tabulations cover from 5 to 29 States, depending on the items included in the table. The number of States covered in tables of marriage and divorce characteristics varies not only from table to table but sometimes from year to year, making trend comparisons difficult and area comparisons all but impossible. This appraisal ignores the historical difficulties and the real progress that has been made (30, 31), but discussion of these points is outside the scope of this paper.

In thinking of the potential use of marriage and divorce data as components of family statistics, we should not confine ourselves to the existing fragments, which obviously can have only limited application at present, but instead we should think of what kinds of data might be acquired and applied.

The National Office of Vital Statistics and the American Association of Registration Executives have submitted a proposal to the Association of State and Territorial Health Officers for the establishment of a marriage registration area to be followed by the establishment of a divorce and annulment registration area.

The reasonable criteria for the admission of States to the marriage registration area which were developed by the Public Health Conference on Records and Statistics (32) will permit the inclusion of about 26 States at the outset.

The objective is the collection of a uniform body of data, consistent for all States in the initial area and eventually for the entire Nation, that will maximize the value of the statistics obtainable from items reported on marriage and divorce records.

But if all this were achieved, the present certificates alone could provide only a fraction of the family data needed. Although the present certificate data are indispensable as a base, there is much more information to be acquired.

How do we go about exploring the potentials in family statistics? The question has special application to the organizations directly concerned with vital and health records and statistics: the statistics section of the American Public Health Association, the American Association of Registration Executives, and the Public Health Conference on Records and Statistics. The initiative should come from vital statistics and records people because they are in the best position to know the possibilities and the limitations of vital records as a source of family data.

Each of us concerned with records on individuals should search for additional items for cross tabulation that would enable us to connect individuals as family members and to connect marriages, births, deaths, and divorces of these individuals as related events occurring in families with particular characteristics.

To serve the statistical needs of public health, it is time we broadened our concepts to include statistics on the family as a unit as well as on the individual. None of us at this stage can be expected to come up with immediate, definitive answers on the specific content of vital certificates, on appropriate technical methods and mechanisms, on the total scope of benchmark family statistics, or on any particular office's proper share of the collection of these data. It will take considerable work and discussion within our organizations to formulate even the first actual steps, but here are some specific lines that seem to be worth exploring.

1. From a family-oriented viewpoint, what can be done to improve the systematic data collection from birth, death, marriage, and divorce records? In reexamining the standard record forms, especially in connection with future revisions, what statistical elements re-





A FOCAL POINT IN HEALTH EDUCATION

# THE FAMILY

Last April, the 16th Eastern States Health Education Conference at the New York Academy of Medicine dealt with the family as a "focal point in health education." But the main emphasis was on the family as a focal plane for health practice, as a basic ingredient of the social process. The program talks and lively discussions were sparked by questions and comments from the floor, as the audience discovered new resources and unsuspected peaks and valleys on what had been thought to be familiar terrain.

The full text of the papers offered is to be published by the academy, under editorship of Dr. Iago Galdston, secretary of the Committee on Medical Information. Dr. Galdston also is secretary to the conference committee, headed

by Dr. Herbert B. Wilcox, chairman. He will welcome inquiries or suggestions with respect to this conference or future ones. The address is 2 East 103d Street, New York, N. Y.

*Public Health Reports* is publishing briefs intended to touch upon a few of the salient issues suggested by the speakers. This treatment necessarily omits essential background discussion and illuminating details. The charts which appear in this conference report were among those given the delegates in the statistical survey prepared by Edward A. Lew.

A paper by Dunn and Gilbert discussing the need for improving family statistics for public health applications precedes this section (pp. 1002-1010).

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of the family as a unit. And about the same time, family welfare agencies, once absorbed in relieving cold, hunger, and the need for clothes and shelter, began to broaden their services.

### **Dogmatic Opinion to Objectivity**

During the early days, each piece of educational literature contained a heavy dose of moralizing based on Victorian ideals. Shortly after the end of World War I came the fault-finding and finger-shaking approach which tended to favor the child-centered home and to find fault with the parents. Articles in slick-paper magazines carried such titles as "1, 2, 3 for Better Parenthood" or "Temper Tantrums? You're at Fault!"

In recent years, research has produced a greater degree of objectivity, and it has challenged many of the earlier assertions. For example:

1. Three studies refute the notion that fathers are of diminishing functional importance in the personality development of American children.
2. Three studies fail to support the idea that interfaith marriages are less likely to be happy than marriages of those of the same faith.
3. Conflicting findings in dozens of investigations challenge the idea that personality development is adversely affected if a child is an only child.

Another trend apparent in the family life education movement is that from personal or neighborhood concern to professional concern supported by charitable foundations and universities and to public concern backed by Federal, State, and local funds. Interest was first exhibited by groups of parents who wanted to learn how to rear their children. Early support for research came from foundations and was carried out at universities. Family life courses were first introduced in colleges.

### **Opportunities Unlimited**

Health agencies have countless opportunities to participate in the movement for generalized family life education. Many aspects of the prevention and control of disease and the promotion of health can be approached effectively through the family framework. Nutrition, for

example, is more than vitamins and proteins or calorie charts. It is the food customs of families that help give a larger purpose and meaning to mealtimes. Cancer is more than a question of early symptoms and the search for a cure. It is the adjustment of a family to a crisis, a test of its stability.

## **Changing Family Profile**



The profile of the American family has changed markedly in the past 15 years.

More persons than ever before live in families. Americans are marrying earlier in life. The level of births continues to set new high records each year. And family size shows an upward trend.

Living in families are 94 percent of the population, with an average of  $3\frac{1}{3}$  persons per household.

The number of families has increased 28 percent, from 32,166,000 in 1940 to 41,202,000 in 1954, or almost one-fourth more rapidly than the total population (table 1).

Husband-wife families have accounted for almost the entire increase. The number of married couples in 1954 exceeded 37,300,000. And all but about 1.5 million had their own households, reflecting a considerable decrease in doubled-up families prevalent during the war years.

It is significant that married couples represent 7 out of every 8 families with their own households. Of the other than husband-wife families, approximately 3 out of 4 are headed by a woman, denoting mainly that there are many more widows than widowers and that many husbands are serving in the armed forces or are away from home for other reasons.

The marriage rate, which spurted to an all-

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*By Edward A. Lew, actuary and statistician of the Metropolitan Life Insurance Co.*

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# Evolution of the Character Of Family Life Education



In a book published in 1881, "Gems of Knowledge," Dr. Paul Barrington wrote that women have as much right as men to choose a life companion.

This—and other statements in a similar vein—contrasted sharply with the Victorian view of women as chattel and the family as an institution for the pleasure and comfort of men. A new point of view was emerging—a point of view that recognized the need for study of the family and its members and the values of education for personal and familial living. What has happened since Dr. Barrington's day may be traced in the accompanying list of significant events.

In the beginning, organized interest was centered on some particular member of the family or some special aspect of family living: children, mothers, or sex, for example. No thought was given to the family as a whole. During the 1920's and most of the 1930's, the focus was on children and how they could be taught habits and how best to discipline them. Family relationships were reduced virtually to a set of rules.

The 1920's saw the beginning of courses in family living in colleges, but what gave generalized family life education one of its biggest boosts was the change in the concept of education itself. High school was recognized as the privilege of everyone and therefore a key place for education for marriage and family life.

Originally, family life courses in high schools concentrated on generalizations about the family, but the youngsters were not content with this. They wanted their questions answered, questions about sibling rivalry (though they wouldn't use those words), petting, or going

steady. Thus, the discussion technique in family life courses evolved, and with it, the need for teachers trained in the subject.

Concurrently, parents, too, sought to find answers to family issues. General interest in the family court concept in the late 1930's showed that the legal profession was beginning to think

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## Significant Events

**1877.** Family service agency established in Buffalo in recognition of the need for casework services for the whole family.

**1888.** Child Study Association of America founded in New York by a group of parents who wanted information on how to bring up their children; Association for Child Study and Parent Education organized in Chicago by a group specifically interested in child psychology.

**1896.** National Congress of Parents and Teachers founded for the study of the child at home and at school.

**1911.** Family Welfare Association of America organized to bring together persons and agencies engaged in family casework.

**1914.** Family court established in Hamilton County, Ohio; American Social Hygiene Association founded to promote "those conditions of living, environment and personal conduct which best protect the family as a social institution," with emphasis on suppression of prostitution and reduction of venereal diseases.

**1918.** Federal funds made available to the States for venereal disease control and education.

**1922.** Federal funds made available to the States for maternal and child health programs.

**1925.** Marriage preparation and family living courses introduced at the University of North Carolina.

**1938.** National Council on Family Relations organized to provide a meeting ground for all who share in helping the family solve its problems.

**1951.** American Social Hygiene Association began expanded programs in education for family life; projects aimed at teacher preparation for family life education courses started soon thereafter.

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20-24 are now married, or have been, compared with only 28 percent in 1940. At ages 25-29, the proportion now is 72 percent compared with 64 percent in 1940.

The median age of men at first marriage is only about 23 and that of women barely 20.

A study recently made by the National Office of Vital Statistics of the Public Health Service points out that 1 in 3 couples marry on a "shoe-string," with an income of less than \$60 a week.

Currently, about 11,800,000 married women, 29 percent of the total, are in the labor force. While it has long been customary for young wives to work until the baby came, recently more and more of them are returning to the labor market as the children grow up. Thus, about a third of all wives at ages 35-54 now work outside the home; for the younger women the proportion is about one-fourth. The fact that 2 out of 3 married women live in urban areas enables them to take advantage of employment opportunities.

### The Baby Boom

Even more remarkable than the recent increase in the married population has been the continuing boom in babies. Since the close of World War II, births have averaged 3,800,000 annually, with each of the past 5 years suc-

cessively establishing new high records. Almost 4,100,000 babies were born in 1955, the equivalent of a rate of 24.9 per 1,000 population.

Accounting in part for the unprecedented number of babies born in recent years is an almost uninterrupted rise in fertility from its low level in the 1930's. In each of the postwar years, about 1 out of every 6 married women under age 45 bore a child, whereas in the mid-1930's the proportion was only 1 in 8.

The rate for first births began to climb immediately after 1933 and spurted sharply in 1941 and 1942. Demobilization brought an even greater jump in the birth rate of first babies in 1946 and 1947.

The upward trend in the birth rate of second and third babies since the beginning of World War II has raised such birth rates to considerably higher levels than those prevailing in the 1920's. Since about 1951 there has also been a definite rise in the birth rate of fourth and fifth children. This trend certainly presages a return to moderate-sized families, but it is not likely that families will become as large as those 50 years ago.

The high birth rates of the past decade are, of course, reflected in the proportion of families with dependent children, particularly among the younger married couples. A large proportion of families have a child within 5 years

**Table 2. Percent ever married according to age, by sex, United States, 1890 to 1955**

Age group, years	1890	1900	1910	1920	1930	1940	1950	1955
Males								
14-19.....	0.4	0.9	1.0	1.8	1.5	1.5	2.9	2.9
20-24.....	19.1	22.1	24.5	29.0	28.8	27.8	41.0	51.2
25-29.....	53.9	54.0	57.0	60.3	63.1	64.0	76.2	71.9
30-34.....	73.3	72.2	73.7	75.7	78.7	79.3	86.8	85.1
35-44.....	84.5	82.9	83.1	83.7	85.6	86.0	90.4	91.1
45-54.....	90.7	89.6	88.7	87.8	88.5	88.9	91.5	91.5
Females								
14-19.....	8.0	9.4	9.7	10.8	10.9	10.0	14.4	14.2
20-24.....	48.1	48.3	51.4	54.3	53.7	52.8	67.7	70.9
25-29.....	74.6	72.4	74.9	76.9	78.2	77.2	86.7	88.4
30-34.....	84.8	83.3	83.7	85.0	86.7	85.3	90.7	92.9
35-44.....	90.1	88.8	88.5	88.6	89.9	89.6	91.7	93.1
45-54.....	92.8	92.1	91.3	90.3	90.8	91.3	92.2	93.2

SOURCE: Bureau of the Census.

**Table 1. Family units in the United States, 1940 and 1954<sup>1</sup>**  
(numbers in thousands)

Type of unit	Total	Own household	Type of family		
			Husband-wife	Other male head	Female head
	Units, 1940				
Families.....	32, 166	-----	26, 971	1, 579	3, 616
Primary.....	31, 491	31, 491	26, 571	1, 510	3, 410
Subfamily.....	2, 062	-----	1, 546	<sup>2</sup> 56	460
Secondary.....	675	-----	400	69	206
Unrelated individuals.....	9, 277	-----	-----	4, 800	4, 477
Primary.....	3, 458	3, 458	-----	1, 599	1, 859
Secondary.....	5, 819	-----	-----	<sup>2</sup> 3, 201	2, 618
All types.....	-----	34, 949	28, 517	-----	-----
	Units, 1954				
Families.....	41, 202	-----	36, 041	1, 336	3, 825
Primary.....	40, 961	40, 961	35, 875	1, 326	3, 760
Subfamily.....	2, 107	-----	1, 305	98	704
Secondary.....	241	-----	166	10	65
Unrelated individuals.....	9, 700	-----	-----	4, 075	5, 625
Primary.....	5, 932	5, 932	-----	1, 904	4, 028
Secondary.....	3, 768	-----	-----	2, 171	1, 597
All types.....	-----	46, 893	37, 346	-----	-----
	Individuals in units, 1954				
Families.....	147, 953	-----	<sup>2</sup> 131, 784	<sup>2</sup> 4, 125	<sup>2</sup> 12, 044
Primary.....	147, 248	147, 248	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )
Subfamily.....	<sup>2</sup> 5, 920	-----	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )
Secondary.....	705	-----	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )
Unrelated individuals.....	9, 700	-----	-----	4, 075	5, 625
Primary.....	5, 932	5, 932	-----	1, 904	4, 028
Secondary.....	3, 768	-----	-----	2, 171	1, 597
All types.....	157, 653	153, 180	131, 784	8, 200	17, 669

<sup>1</sup> Excludes inmates of institutions; 1954 also excludes all but 822,000 members of the armed services.

<sup>2</sup> Estimated by the Statistical Bureau, Metropolitan Life Insurance Co.

<sup>3</sup> Not available.

SOURCE: Bureau of the Census.

DEFINITIONS: *Family*—group of two or more persons related by blood, marriage, or adoption residing together. *Primary family*—embraces all the persons related to and including the head of the household. *Secondary family*—head of household is not related to the family sharing his dwelling, such as a group of roomers or resident employees. *Subfamily*—a married couple with or without children, or one parent with one or more children under 18 years, living in a household and related to, but not including, the head of the household or his wife.

time high of 16.2 per 1,000 population in 1946 upon demobilization, has since been declining. In 1955 the rate was 9.3 per 1,000. It is not expected that the number of marriages will vary greatly for several years to come. After the early 1960's, however, there should be a marked upsurge when the large number of babies born during the war and postwar years begin to reach marriageable age.

### Early Marriages

The trend toward early marriage is equally marked for both men and women. In 1955 more than 14 percent of all girls at ages 14-19 had been married compared with only 10 percent in 1940. At ages 20-24 the corresponding proportions for women were 71 percent in 1955 and 53 percent in 1940 (table 2).

Slightly more than half of the men at ages

**Table 4. Widows in the United States, 1930 and 1955**

Age (in years)	1930 (4,734,374)		1955 (7,595,000)	
	Percent of all widows	Percent of all women	Percent of all widows	Percent of all women
14-44.....	18.3	2.9	7.6	1.6
45-54.....	18.5	14.0	13.5	10.8
55-64.....	23.7	27.8	24.9	25.6
65-74.....	23.9	49.0	30.6	46.5
75 and over....	15.6	73.9	23.4	70.9

SOURCE: Bureau of the Census.

postponed to the older ages, it remains nevertheless an important social and economic problem. About 1 woman in every 2 who now becomes a widow before age 60 has 20 or more years of life ahead of her. Nine out of every ten widows live either in their own homes or with relatives. Of the remainder, about one-half live as lodgers or as resident employees; one-fourth live in hotels or similar places, and an equal number in homes for the aged or other institutions. Many widows past the prime of life are in the labor force.

## Psychological Dynamics Of the Familial Organism

**PHR** A new prototype of the American family is emerging from the steadily changing patterns of family organization.

There is the changed position of women in society, their new role in industry, their achievement of equal rights with men, their sexual awakening and emancipation. Also there is the removal of the working father from the home,

By Nathan W. Ackerman, M.D., associate clinical professor of psychiatry, Columbia University.

the mother's expanded domination of home and children—the whole tradition of “momism.” With all this has come an inevitable shift in the relations of men and women, and in child-rearing attitudes. The homestead has been stripped of the traditional functions of work, religious worship, schooling of the children, and care of the sick and aged.

The values of self-selection of mate, of compatibility in marital relationships, and of child-centered family life are accentuated. But the increased freedom, while promoting greater creativeness, also induces confusion and turmoil in family roles. What a man expects of a wife and what a wife expects of a husband has become complicated by a multiplicity of needs, many of which are contradictory in nature.

### Unit of Diagnosis—the Family

Many persons and many families feel insecure, confused, and isolated in their community position. They perceive these rapidly changing social patterns as menacing and as a withdrawal of support. Young parents, separating themselves from the older generation but failing to find a substitute in the wider community, feel alone and adrift. They undergo personal torment in searching out an appropriate path. Their torment intensifies the strain in family relations and imposes an additional burden on the family's inner life. The family then tries to compensate to an exaggerated degree for the individual's lack of security in the wider community by providing a protective barricade against what often seems to be a cold, harsh outside world.

The experience of the modern family underscores the fact that accurate psychiatric evaluation and effective treatment of individual patients is simply not possible unless the disturbances of these individuals are defined in the context of their emotional position in their family. The family is the unit of growth and experience, and therefore the unit of health and illness. There must be a shift of interest from the individual as the unit of diagnosis and therapy to the family group as the unit of diagnosis, therapy, and prevention.

Clinically, the first person to seek psychiatric help may prove to be either the most or the least

**Table 3. Child dependents among married couples according to age of husband, United States, 1940, 1950, 1953**

Age of husband (in years)	Percent with one or more own children under 18 years			Own children under 18 years per married couple with children	
	1940	1950	1953	1950	1953
14 and over.....	58.1	54.6	55.7	2.07	2.15
14-24.....	49.4	56.1	61.2	1.41	1.57
25-34.....	69.2	76.4	80.0	1.94	2.13
35-44.....	78.2	77.5	79.4	2.40	2.41
45-54.....	59.3	49.2	37.6	2.03	1.98
55-64.....	34.8	19.5		1.77	
65 and over.....	17.1	5.1	4.6	1.61	1.70

SOURCE: Bureau of the Census.

of marriage. The average number of children per family has also increased appreciably where fathers are under 35 years of age (table 3).

Children under 18 years of age now number nearly 57 million, an increase of 15 million in the 11 years since the end of World War II. This increase has broken all previous records and is greater, in fact, than the gain in the preceding half century.

The total number of children is expected to continue to climb, and by 1965 it is estimated that there may be upward of 65 million children

under 18 years in the United States. This would mean a somewhat larger average family than we have now.

Currently, close to 8 million children under 18, almost one-seventh of the total, live with only one parent or with neither, mainly because of family disruptions through death, divorce, or separation. Of these, almost three-fifths live with their mother, about one-tenth with their father, and the remainder under a variety of other arrangements, mainly other relatives.

The problem of orphanhood has been diminishing, but about 1 percent of the children under 5 years, 9 percent at ages 10-14, and 14 percent of those at ages 15-17 are orphaned.

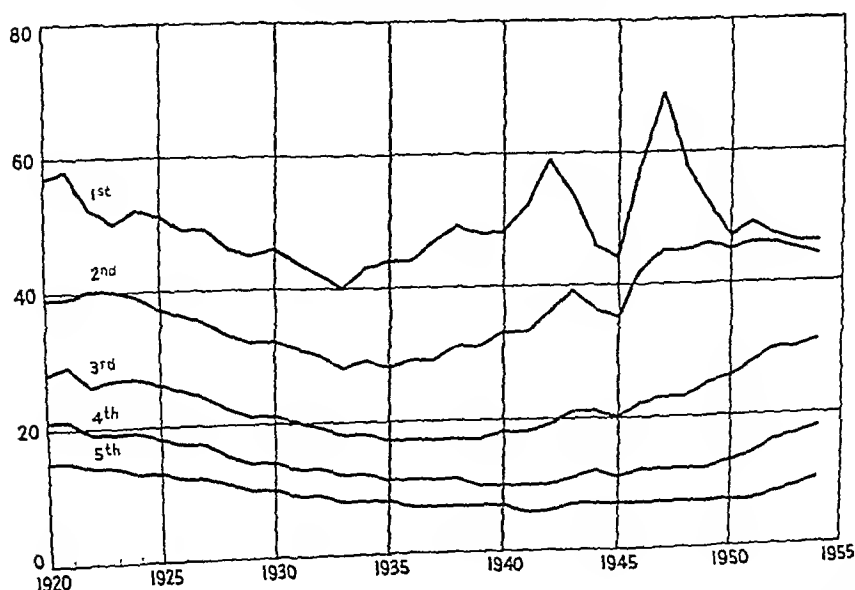
### Widowhood

Even though the number of widows in the population has been mounting rapidly, the proportion of women who are widows has been decreasing at every period of life. This is mainly the result of the decline in mortality.

Of the 7,600,000 widows, more than half are 65 years of age or older; two-fifths are in the age range 45-64, and less than one-tenth are under 45. Many of the widows in the younger age brackets have dependent children in their care (table 4).

Although widowhood has been increasingly

**Births per 1,000 married women aged 15-44 years, by order of birth, United States, 1920-54.**





The interrelations of individual behavior and family relationships need to be scrutinized in three dimensions: the group dynamics of the family; the dynamic processes of emotional integration of the individual into his family role; and the internal organization of individual personality and its historical development. The phenomena of family role constitute the bridge between the internal processes of personality and the group pattern of the family.

### Purposes Served by Family

The family serves biological continuity by providing a socially supported group pattern for the sexual union of man and woman and a quality of parental partnership essential to the care of the young. The family is literally the cradle for the infant's tender mind as well as his body. Concretely the purposes served by the family are:

To provide food, shelter, and other material necessities which sustain life and protect it from external dangers; to form a matrix for the affectional bond of family relationships; to give opportunity to evolve a personal identity, tied to family identity, which supplies psychic integrity and strength for meeting new experiences; to set the pattern of sexual roles, preparing the way for sexual maturation and fulfillment; to establish social and ethical standards for social roles and acceptance of social responsibility; to cultivate learning and support individual creativity and initiative.

One important feature of family identity is its stability, its internal capacity for self-regulation and for restoration of a state of balance following an upset. There are at least two kinds of stability. One is characterized by resilience and capacity for accommodation to change and the other is marked by a rigidity toward change. In the meeting of new problems and crises, some families are weakened and others grow in solidity and emotional strength. Some families grow and learn from experience; others seem unable to do so because they are too inflexible and tend to disintegrate.

Families differ in their capacity to restore emotional balance. If this balance is not restored after disturbance, the inevitable consequence is a breakdown in emotional communica-

tion and empathy, increasing alienation in family ties, and confusion and impairment of family identity.

The interrelations of marital and parental identity and individual identity are delicately balanced. In a healthy family, out of the fusion comes a richer, stronger individual identity. The differentiation of the separate self is as important as is the basic family unity. The quality of difference in a family member need not be felt as a threat, any more than sex difference is a threat. Instead it should be welcomed as proof of the complementation of the self, the opportunity for new learning and greater fulfillment.

Mental health cannot be conceived in "all or none" terms. In emotional terms, people are neither wholly sick nor wholly well. Since mental health is largely a function of social processes, the more suitable test is the individual's integration into his group, rather than his personality structure defined in abstract terms. Surely mental health signifies the absence of mental illness, but it is much more than this. It implies confidence, courage in facing new experience, the capacity to grow, to learn, to live fully, to love and to share with others the adventure of life—in other words, a concern for the common good.

## Family Health Maintenance



Social agencies have known for years that they must reach families before social and emotional disorders become fixed. The broken home, the vanished parent, the child in custody, all underline the fact that agency jobs are salvage jobs. Trends in medicine have coincided with trends in social welfare, and there has been a growing awareness of the interplay of social factors and

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*By George A. Silver, M.D., chief, division of social medicine, Montefiore Hospital, Bronx, N. Y.*

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sick member of the family. In evaluating the primary patient, it is important to trace the lines of significant involvement with other family members and to judge the illness as a reflection of the level of the family's emotional functioning. It is important, too, to discern in the arena of family life where lies the most critical focus of conflict and anxiety, to determine whether the core of the disturbance rests in the illness of one member or in the conflict of a particular family pair. Or does the conflict pervade all family relationships? In this sense, the behavior of one member may be interpreted as a symptomatic reflection of the emotional distortion of the entire family.

**Basic Principles of Diagnosis**

A system of family diagnosis calls for the evaluation of the group patterns of the family, the personality dispositions of each member, and methods of correlating individual experience and group interaction. Three empirically documented principles are relevant toward evolving such a system.

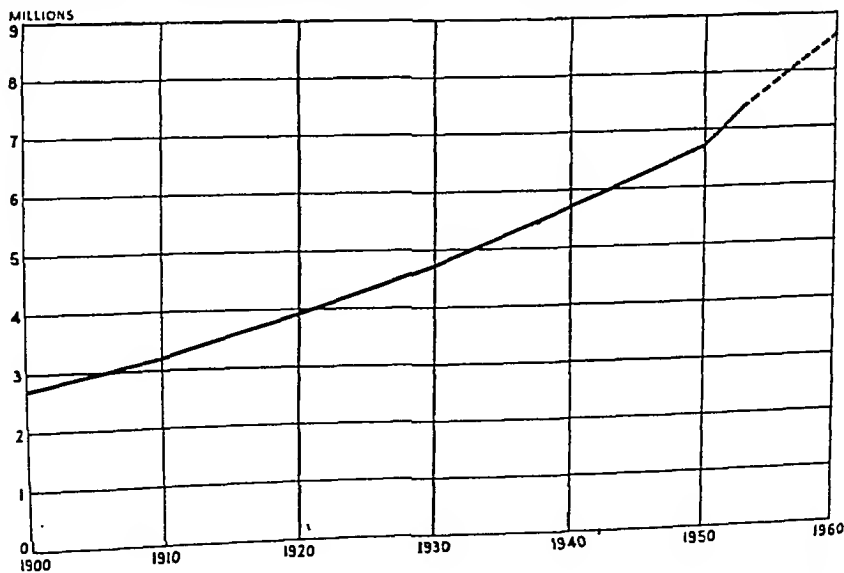
1. Abnormal behavior in adult persons is significantly rooted in the experience of childhood integration into a particular family, but continues to be molded by current family experience.

2. The diagnostic evaluation and therapy of emotional disturbance in a child, viewed as an individual apart from his family environment, is impossible. The proper unit for study and treatment is the child seen as part of the family, the family as part of the child.

3. Personality disorder and disturbances in social adaptation of adult persons may be better understood if examined not in isolation but as a dynamic changing pattern influenced continuously by the reciprocal effects of family interaction. Deviant behavior is thus seen not merely as a projection of fixed intrapersonality distortion but also as a functional expression of emotional interplay in significant personal relationships. The way in which the person perceives the image of others influences his image of self and vice versa. This two-way process continuously molds feeling, attitudes, and action.

Personality, born and bred in the social matrix of the family, and family and culture may be regarded as behavior systems existing at different levels of experience, each interdependent although interpenetrating parts of a whole which change and shift over time. Stability within the person and stability in the relations of persons and environment are mutually contingent, and the life and growth of the individual are inconceivable except within the group.

**Number of widows in the United States, 1900-1953, and forecast for 1960.**



Whether physical or emotional, preventive or therapeutic, individual conferences, group discussions, or consultations with parents about themselves or their children, action requires the resources of the entire team.

One important function of the health team is the service it can give in emotional upsets. However, a consulting psychiatrist orients and supervises the team members, inculcating psychiatric attitudes, information, and some techniques. He helps the team members to use the new skill to improve their own functioning and to add a new dimension of help to the patient.

The consulting psychiatrist does not actually perform services for patients. In weekly conferences with the team members he offers general information on psychodynamics, on patterns of behavior, and perhaps on a specific case or family. His social usefulness is enhanced many times by this means, and it may be that only through such organized service as a health team with a consultant psychiatrist will it be possible to bring the mental health approach into the medical care system.

### Basic Hypotheses

Definitions of such terms as "health," "anxiety," "help," "guidance," and "support" were agreed upon early in the demonstration.

"Health" was defined as "harmonious functioning" in various facets of living. Emotional health is intimately tied to family relationships. Parents represent a profound influence in the health, or harmonious functioning, of the child and, consequently, of the adult since, as stated by Bowlby, "the form our family relationships take when we are grown up are, to a high degree, dependent on the form they took in our early years, and the very first relationship we make—that with our mothers—is the most important of all." The causes of failure in marriage often lie in family stress in the previous generation. Realization of this cyclical quality of emotional disturbance led us to concentrate health promotion efforts on providing parents with some knowledge and understanding of defects in their marital relationships, not to assess damages against them or their children.

In the early part of the study, more than half of the reports of doctors and social workers

noted "anxiety" among family members. The term needs clarification. Anxiety as a response is useful and necessary, provided it is not more than the stimulus warrants. Our concern is with types of anxiety in which the response is disproportionate to the stimulus and interferes with an individual's effective functioning in all areas of living.

This concern for emotional disturbances is within the family setting, and it is within the family setting that maximum effort should be concentrated. However, stresses such as low income, prejudice and segregation, and national and international political tension must also be weighed and considered in evaluating help for the family.

The demonstration is concerned with giving "help, guidance, and support" in physical as well as in emotional stability and growth. Injections and vaccinations are given against contagious disease. The public health nurse attempts to provide the latest information on nutrition, particularly to pregnant women. Poor or inadequate housing is dealt with as constructively as possible.

### Health Education

A variety of personal and group educational approaches are used in maintaining family health. These include conferences, literature, informal discussions, and group discussions. Family conferences, in which parents meet the whole health team, are valuable. After the initial study and evaluation of each family are completed, a schedule or plan for health supervision is discussed in conference between the family and the health team. The knowledge that this group of professional people is concerned and interested and is offering suggestions is very gratifying to the family.

Although attendance at group meetings was not large, the health team was gratified to be able to reach even a small proportion of the study families. Some of the reasons suggested for the small attendance are competing entertainment and the accessibility and perhaps repetitiousness of educational forums in schools, churches, and neighborhoods. Ease of access to individual conferences also may militate against attendance at group discussions.

disease. Molding the environment, health promotion, and prevention of social illness must be combined with treatment of all disease.

The organization of medical care for the family must consider its needs, modern knowledge of prevention and treatment in both the physical and the socioemotional fields, and the cost—the cost of organizing health service and the cost of not organizing it.

A research demonstration in health promotion and preventive medicine is being conducted at Montefiore Hospital under the joint auspices of the hospital, the Columbia University College of Physicians and Surgeons, the Community Service Society, and the Milbank Memorial Fund.

Selected at random from the Montefiore medical group of the Health Insurance Plan of Greater New York are 150 families and an equal number of matched controls. Advantages and disadvantages of participation in the study were discussed frankly with all participants because, while it was important to get as many families as possible to cooperate, it was equally important that these families continue participation to the end of the program. The controls responded to a long and time-consuming questionnaire in approximately the same proportions as the study families participated in the demonstration.

## Evaluation

The information collected from the families is to be used as baseline data. From this information an evaluation schedule is filled out and a numerical score is given to each individual in 11 different areas. At the end of the 4-year study period, similar information schedules will be completed and evaluation forms will be filled in. From these, the study families can be compared with themselves and with each other as well as with the control families, who will have a final evaluation of the same order.

No equally comprehensive initial evaluation was made of the control families. However, they have filled in a Cornell medical index and supplied housing and nutritional schedules. We have physical examination reports in their HIP charts, also.

## The Health Team

In the demonstration, the health team is composed of a physician, a public health nurse, and a social worker. Medical care, preventive medicine, health education, health promotion and guidance, and psychiatric advice and some psychiatric help are the elements of the team's functions.

Medical consultants aid in diagnosis and treatment through the matrix of medical group practice. A social scientist consultant offers specialized skills in diagnostic and treatment methods appropriate to social factors, social disability, and social disorganization. A psychiatrist, a psychologist, and a health educator also serve as consultants.

The decline in numbers of general practitioners and the increased medical knowledge, diagnostic and therapeutic equipment, and skill have necessitated a medical adviser who is closer and more accessible to the family than the specialist. Fortunately, a link between doctor and patient is already in existence. Public health nursing and medical social work arose in response to such a need. With changing attitudes of physicians and loss of rapport between doctor and patient, public health nurses and social workers have been developing in skill and numbers. In the demonstration, the new, important aspect of their roles is prevention—to reach into families before disaster strikes.

The public health nurse herself shares in many areas of the doctor's role that deal with preventive medicine in the areas of nutrition and health teaching. In the area of interpersonal relationships, the social worker has become the professional practitioner, helping patients to understand their problems, providing access to other agencies and sources of care, and "shoring up" the emotionally sick and the socially disabled.

The health team can act as the family's guide and adviser because it has information, authority, and the confidence of the patient. Internally, the team must operate with mutual confidence. The Montefiore team has no captain; decisions reached in conference are referred to the person with competence in a given area or to the person with whom the patient has the closest relationship.

bers of the family, and his role in and relations with the community itself. The need of reducing the record to diagnostic and summary terms leads into the consideration of several general questions of instructional importance. One family's history illustrates two such questions: (a) the problem of selecting the initial steps and the frequently limited goals possible in aiding the restoration or promotion of family functioning and personal health and (b) the opportunity of examining the family for identification of diseases which have a familial risk.

The husband, an unskilled laborer, had been unemployed for a year. He had asthma and bronchitis, and official agencies were about to investigate the possibility that these conditions were sufficiently disabling to justify the transfer of financial support of the family from the category of home relief (for the fully employable) to that of aid to dependent children. He was found to be depressed, showed striking symptoms of self-devaluation, and his relations with his wife had deteriorated to the point of consideration of divorce.

Although the wife had not handled the family funds when the husband was the provider, she had since taken over the handling of public assistance funds. She seemed competent as a mother, but her ability as a wife was more open to question. Perhaps childhood illness and experiences, or the lack of much of a childhood—she had worked in a factory from age 8 to 18 years—may have qualified her ability to relate on a mature level.

A problem such as the unemployment of the head of the family offers a series of choices in the attempt at solution. Determined agency activity in finding the husband a job might restore his status again as the main provider and head of the household. Referral of the wife to a family agency for a fuller understanding of her situation and of her attitudes toward her husband and even of her version of his behavior might identify which adult member in the family is the better able to form a relationship. Or the husband might be referred to a psychiatrist for an examination to determine whether his behavior is evidence of a psychological disorder that may disqualify him for work or for certain kinds of work.

The nature of the training and experience of

health personnel may be the main determinants of the choice of one of these directions toward more healthful functioning. The physician, the social worker, and the public health nurse each select a different approach to this family's problem. Further, there are times when vocational advice may require inquiry into the health status of family members and understanding of family relationships.

### Family Disease and Familial Risk

In the care of an individual or family a doctor's concern must include attention to resistance and susceptibility to disease. Ideally, in a full appraisal and in anticipating susceptibility to disease, inquiry needs to be extended to all relatives, living and dead, to pregnancies unfulfilled, and even to the yet unborn. Such a case study approach will provide students and teachers with data for a discussion of existing knowledge, or lack of knowledge, of the mechanisms of disease as influenced by genetics and by environment.

As a teaching device we may conceive "family disease" as multiple cases of a disease among relatives or single cases of disorders known to carry a "familial risk" to children. In the family mentioned previously there were two likely instances of disorders associated with familial risk to children. The mother had dextrocardia and 1 of the 5 children had epilepsy. Two maternal aunts and the maternal grandmother had gallstones, but it is not known whether the mother had gallstones as well. She had eclampsia on one occasion and her mother had hypertension. Little of significance can usually be drawn from the history of more distant relatives. On the subject of disorders known to be common, there were nutritional deficiencies, and these were presumed to be due to the family's marginal economic circumstances.

The term "familial risk" denotes an empirical observation without the usual assumption of genetic etiology. Families share common environments as well as common genes, and families in consecutive generations show some tendency to remain within the same cultural, religious, and economic groups. In the family studied, two possible familial risks were present, epilepsy and dextrocardia. Because the

# The Physician And the Family

**PHR** The character of the professional relationships of a physician both with the families of his patients and with his associates in health education and family care will be affected directly by the kind of education he receives in medical school. Recently developed teaching projects designed to advance the practice of health education in family living are evidence of a trend toward educating the physician to understand the health of the patient in relation to the family environment.

The origins and reasons for this movement are complex; their contributors, both individual and organizational, are many. In the past quarter of a century, the Association of American Medical Colleges particularly has emphasized the importance of appraisal of social and environmental factors in clinical teaching. The 5-day teaching institute held in 1952 by the Conference of Professors of Preventive Medicine and the Association of American Medical Colleges at Colorado Springs, Colo., gave considerable impetus to the further expansion of comprehensive medical care teaching demonstrations, with emphasis on home and ambulant care.

Of interest is the extent to which departments of preventive medicine have a responsible role in this form of extramural teaching, the appearance of psychiatry in a consultative teaching function on behalf of other departments, and new administrative arrangements and purposes in the relations of clinical departments for the demonstration of medical care. The Cornell comprehensive care and teaching program and

Boston University's domiciliary medical care program are good examples of the latter.

## The State University Project

As a learning device and as a form of service, the value of simultaneous appraisal of all members of a household has been demonstrated in the Family Health Study Program of the State University of New York College of Medicine at New York City. This family medical and social appraisal is the major project of a 1-month full-time clerkship in environmental medicine and community health carried on at the health department's Red Hook-Gowanus District Health Center in Brooklyn, N. Y. Each senior medical student is assigned a family chosen for the program by the health center's community nursing service and as much of the study as possible is conducted within the family home in a series of frequent visits.

Physicians, social workers, public health nurses, social scientists, and staff of community agencies serve as consultants to the student and evaluate his findings with him individually and in groups. The recommendations found most acceptable in the joint conferences are acted upon by the public health nurse in the further use of community agencies for continuing care.

The totality, size, and concentrated time span of the family studies of this program differ notably from what is usual in family medical practice where the physician's contact with a family is usually episodic and in response to a call for the care of the family member who is ill. In the State university study program all family members are equally the object of attention in the same time period. Some of the examinations performed go beyond those commonly made by a practicing physician; for example, after the student-family relationship has become stabilized, examination may be made of the home to discover hazards that might cause accidents.

## The Student's Appraisal

In making his report, the student appraises each member of the family at three levels, according to the individual's personal health, the latter's role in and relations with other mem-

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*By Duncan W. Clark, M.D., professor and chairman, department of environmental medicine and community health, College of Medicine, State University of New York, New York, N. Y.*

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bers of the family, and his role in and relations with the community itself. The need of reducing the record to diagnostic and summary terms leads into the consideration of several general questions of instructional importance. One family's history illustrates two such questions: (a) the problem of selecting the initial steps and the frequently limited goals possible in aiding the restoration or promotion of family functioning and personal health and (b) the opportunity of examining the family for identification of diseases which have a familial risk.

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parents in this family were cousins, the question was pertinent whether children as yet unborn to this marriage might be heir to dextrocardia. However, since as many as five children had been born without this rare congenital defect there is little probability of a later child having the condition.

### Attitudes Affecting Counseling

The possible role of personal and professional attitudes in counseling may be illustrated in a study of a family of four. The father had advanced pulmonary tuberculosis, one child had recently recovered from chorea, and the other child had had rheumatic fever for 2 years and had been in a special institution for this disease. The mother had gone to work 6 months earlier, at the time of her husband's hospitalization. There had been no untoward consequences to the children with the mother at work, but the question was raised speculatively in conference whether she should have made this decision.

The 16 medical students unanimously agreed that the mother should have gone to work. But medical students believe in hard work, and they have a strong pragmatic streak. After all, they seemed to say, the woman had been working for 6 months with no serious consequences to herself or her children.

The intended implication of the question was what response representatives of special fields might make to the question of the advisability of the mother's employment, according to their professional knowledge and orientation. The following responses might have been made.

A pediatrician might be primarily concerned with the fact that two young, recently convalescent children were unattended on their return from school.


A psychiatrist might feel that the wife's pursuit of work, while relieving anxiety in her, could have an emasculating effect on the husband and could pressure him to a premature return to work.

An anthropologist might say that it is traditional for Puerto Rican women to work hard and that the mother's employment was a decision acceptable to both sexes of this ethnic group.

An internist might feel that prevention of

tuberculosis in the mother is the critical issue and that her undoubted recent exposure to the disease should weigh against her working, although his opinion might be based more on clinical prudence than on possession of the facts on the role of work.

## Education for Parenthood

 Modern education for parenthood centers around the family rather than the mother and her infant. Today's classes for families expecting another child now include not only the father but the children, offer shared learning for the greatest sharing experiences in life, seek to expand the boundaries of family feeling, and foster an environment conducive to psychic growth for parents and children.

Apparently, the enthusiastic response to our classes at the Maternity Center in New York City and in other large centers of population coincides with a widespread desire for help. Our classes consistently attract more applicants than there are chairs available. Sometimes, young couples apply even before a child is expected.

In part, we attribute the favorable response to the fact that young couples wish to be equal to parenthood. They feel a need to develop their inner resources. They wish to learn what changes to expect in their relationship to each other and in their pattern of living.

Few youthful parents know what they should about human reproduction. Although the majority in our classes have attended college, they have little real knowledge of how a baby is born. Confronted with the process of birth, they wish to understand rather than wonder. Those able to assimilate medical knowledge seek the help of experts. But rather than imprecise answers,

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By Hazel Corbin, R.N., general director, Maternity Center Association, New York City.

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they seek facts from which to make their own decisions. They are not willing to accept a passive role. This attitude is perhaps more crystallized in maternity care than in other medical services.

Only 25 years ago, emotional security was a concept limited to psychiatrists and other professional workers. The parents of today, conscious of their own personality disturbances, try to create a good emotional climate for their children. They are irrevocably committed to the momentous adventure of parenthood, and they are unsure of their ability to live it well. They need not only to learn the elements of bathing and diapering an infant. They need help also in understanding their own and the baby's behavior. They wish to avoid the mistakes they feel their parents made unwittingly.

Unlike their parents, who often felt they had to possess a house and car before they could afford babies, today's young people base their security on the family and its social value rather than on material things. Whatever adds social value to the family strengthens their sense of security. Since formal education is an important symbol of ego value in our culture, the undervalued role of parent gains in prestige when it is approached by the educational route.

### Individual Goals and Aspirations

Education for parenthood should help the mature individual to derive the utmost satisfaction from the experience and to share that satisfaction with others in the family. It should help the personality to mature in proportion to the complex responsibilities of parenthood. For the unborn child, it should prepare a suitable home.

Education for parents should emphasize the primacy of the home since the disruption of family life is at the root of much unhappiness. It should encourage a broad conception of the family unit to provide the child with opportunities for effective relationships and for learning to live with others. It should provide learning of permanent value so that parents continue to build for happy, healthful living long after they have forgotten the details learned in classes for parenthood.

To be effective, health education must be ac-

ceptable to people. It is important therefore to help the individuals in the group work out their own methods of achieving what they desire. Although a core of pertinent information should be given, it is not desirable to insist on a particular pattern of performance or care. Effective education keeps in mind that individuals and groups are unique in goals, aspirations, and working methods.

By keeping the class small and having it meet over a fairly long period of time, it is possible to practice permissiveness, both in the teaching pattern and in the conduct of discussion. Young people are accustomed to frank talk, with each other and their friends. They are most receptive when the classroom discussion is at this level of freedom. As they become acquainted, the discussion grows in freedom. This spontaneous talk provides the teacher with the key to unexpressed and unformulated feelings.

Today's parents want to know about fertility and infertility, the uses and dangers of anesthesia and analgesia, the pros and cons of natural childbirth and rooming-in, and the psychophysical rationale of breast feeding. Many want movies of an actual birth.

A good educational program gives them the best available information on which to base their choices. The nature of the child, even before birth, is emphasized throughout so that parents are prepared to receive a baby as an individual personality and not merely as their creature, however loved, to be reared in the pattern of their personalities and wishes.

Often parents are far ahead of professional workers in their ideas of what they should learn. In controversial areas, it is wise to explain the difficulties that may prevent full realization of their desires so that they may adjust sensibly when their efforts fall short of complete success.

Whether they like it or not, for example, most women are obliged to have their babies in hospitals. Whether they like it or not, they are usually separated from their husbands during labor and from their babies after birth. If they make a choice between hospital and home based on realistic information, they are usually able to try sensibly to gain the advantages of both and to adjust without trauma if they don't.

## Sharing of Attitudes

Naturally, all of the initiative does not rest with the class. A good discussion leader creates interest in what should be learned and brings about coincidence of teaching and learning goals. In an early session on intrauterine development, for example, we explain the baby's dependence on the mother and her food intake for the baby's body-building needs. Then parents are ready to receive the session on nutrition with real interest in the child's welfare as well as their own.

In teaching nutrition, we explain how different food elements serve the body. We do not say "eat this or that" but help each mother and father achieve good nutrition within the framework of familiar food habits and tastes.

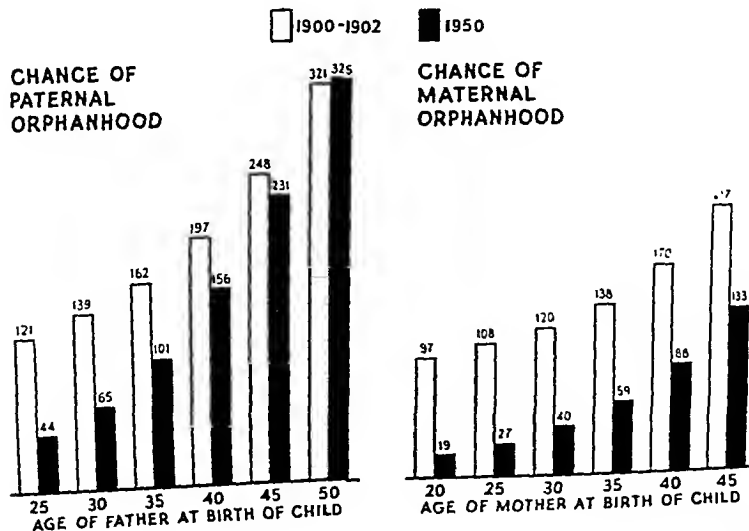
Even though deliberate attempts at psychotherapy should be avoided, there can be no doubt that the airing of hopes and fears is beneficial. Throughout pregnancy, for example, there is a shift of interest back and forth between the child and self. Expectant parents often feel guilty and abnormal when their beginning parental attitudes give way to self-concern. They do not always realize that parental feeling is a developing and not a full-born thing. As they understand that a measure of emotional conflict is universal, they grow in

self-confidence, and the motivation for learning is strengthened.

No large-scale, continued evaluation of parents' classes has been made, though empirically it seems certain that the shared experience has psychotherapeutic value. Mothers comment on the supportive value of what they learned in class. They write of the pleased surprise and appreciation of their physicians at their performance during labor. Nurses report that women who have had prenatal preparation have an easier delivery and react better psychologically. Mothers and mothers-in-law remark on the emotional growth observed in their sons and daughters.

Education for childbearing does not pretend to eradicate neurotic attitudes or deep-rooted personality traits. It does seek to minimize or prevent new traumatic experiences, to help develop insights conducive to a favorable environment for the coming child, and to aid in the reconstruction of the family in a society that in many of its values and practices tends to rupture family bonds. Education for parenthood which is focused on the family and its individual and collective needs, and which fosters a secure, happy family setting, contributes to the welfare of society as well as of individual mothers, fathers, and children.

Chances in 1,000 that a newborn child will be orphaned before attaining age 18: mortality experience of white population, United States, 1900-1902 and 1950.



# Culture and Health Practice

**PHR** Health, once thought to be governed by the heavens, by implacable fates, or by simple principles of will or virtue, was late to be associated primarily with the elements of earth. And even the earthly view has been troubled by the complex interplay of man with environment and of the individual with society.

The concept that ills have a dominantly physical origin, based in microbes or toxins, was barely established before Claude Bernard, Walter B. Cannon, and Sigmund Freud demonstrated that man is a whole compound of related physical and psychological processes. Such men opened the door to the study of the role that human values, emotional attitudes, and habits play in health. Talcott Parsons searched for roots of psychological patterns and influences within human societies and their social processes. Kardiner spoke of social emotions patterned in social structure. Anthropologists investigated social patterns for clues to their origin.

A preoccupation with evolutionary theory in the 19th century favored the thought that men and their societies "progressed" biologically or culturally, with accompanying assumptions of superiority of advanced races or cultures over the "primitives." Assumptions of racial distinction were discredited by Boas, who linked mental processes firmly with culture and led to a searching analysis of cultural variations.

Since culture itself is a human agency or organization of instrumentalities for adjusting and adapting to nature, it bears upon the shaping of personality and health, both individual and public. Individual reactions are mediated by a whole system of values, attitudes, and behaviors, even with respect to heart disease, arteriosclerosis, or amebic invasion.

In 1940, Dr. Leona Baumgartner suggested

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*By Marvin K. Opler, Ph.D., department of psychiatry, Cornell University Medical College, and Payne Whitney Psychiatric Clinic, New York Hospital.*

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that an understanding of the culture of a community would improve the effectiveness of health programs. There are many studies to illustrate how this principle applies in practice. But the culture is complex, requiring insights and knowledge from many contributing disciplines.

The concept of the family as a unit of practice was appraised in 1945 in a report by Dr. H. B. Richardson. Concerted skills of general practitioner, psychiatrist, and nursing and social work personnel were applied for a period of 2 years. It was concluded that the family concept led to better diagnosis and treatment, less pressure on existing clinical facilities, and relatively rapid progress toward sound medical action.

The concept of health and how to obtain it varies with the group, generation, and social class. One may start with existing health practices and behavior, note their function, and their integration into the culture. Such knowledge may become a component of epidemiology and administrative technique for the health officer.

## An Approach to the Study Of Family Mental Health

**PHR** In our clinical studies of patients suffering from neuroses and psychosomatic disorders, we have been impressed by the significance of periods of crisis which, in the early stages of an illness, seemed to have determined its direction. In other cases, a period of healthy emotional development appeared to change more or less abruptly to one of unhealthy development at the time of a crisis associated with an upheaval in the social milieu of the patient.

When Erich Lindemann and I joined forces at the Harvard School of Public Health in 1952,

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*By Gerald Caplan, M.D., D.P.M., associate professor of mental health, Harvard School of Public Health.*

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we began to develop a framework for communitywide preventive psychiatry based on such studies. Our plans aimed to extend mental health help to families at times of crisis by promoting collaboration between psychiatric workers and the caretaking agents of the community—clergymen, educators, nurses, physicians, and social workers.

Lindemann's investigations of the psychological reactions experienced by the survivors and close relatives of the victims of the Cocoanut Grove fire in Boston had convinced him that a mourning process is accompanied by characteristic emotional changes, that there is a well-defined psychological disturbance in direct reaction to a bereavement, and that an individual who does not succeed in handling the emotional problems involved will be likely to suffer from a consequent psychiatric illness. He also found that a physician, or better still, a clergyman could help a person successfully adapt to a bereavement situation and thus prevent the pathological sequelae of "unsuccessful grieving." His experiences in this venture led him to set up the Wellesley (Mass.) Human Relations Service, where community caretaking techniques are being developed to help individuals adapt in a mentally healthy way to a variety of hazardous life crises.

My findings from my studies in London and Jerusalem on the pathogenic effects of interruption or distortion of mother-child relationships in early childhood had aroused in me the hope that the introduction of mental health concepts into public health practice might improve the emotional environment of young children and lead to a communitywide reduction in the incidence of psychological disorder.

Such considerations have led us to a scientific study of certain common crises which we previously felt were the province of playwrights and novelists.

### Our Formulations

Our conceptual scheme constantly emphasizes the interplay between the individual and the significant persons in his social milieu.

When we say that someone is mentally healthy or unhealthy, we are rating the equi-

librium of his functioning in relationship with others in his environment. We are rating his ability to initiate and maintain satisfying emotional relationships with others, to work productively and fulfill his inner resources, to perceive reality undistorted by fantasies, to adapt to his environment if adaptation is conducive to his welfare, and if it is not, to change his environment in a way that infringes minimally upon the rights of others.

The emotional equilibrium is kept stable by a complicated series of homeostatic mechanisms operating both within his personality and in the social system of his network of close interpersonal relationships. Changes in this equilibrium and in the person's state of mental health may occur during crisis periods.

The essence of a crisis is that a person cannot solve quickly a problem of basic importance by means of his normal range of commonly used problem-solving mechanisms but must employ novel patterns of solution.

Pregnancy, birth, death, and such important role transitions as starting school, a new job, or married life are examples of problems demanding novel solutions and involving the possibility of changes in the preexisting pattern of emotional equilibrium.

An alteration in relationships with those who satisfy emotional needs leads to frustration and eventual impairment of mental health.

In the disorganization precipitated by a crisis, old conflicts become symbolically linked with present problems. The pattern of their previous solution may influence the present adaptation.

A critical factor in determining adaptation to the changed situation is the support mobilized by the traditional helping practices of an individual's culture and by significant helping people in his environment. Help at this time produces long-lasting effects quite out of proportion to the effort expended.

The significant people in a person's environment whose behavior toward him is so important during a crisis are the members of his family, his close associates at work, leaders of the social and religious groups to which he belongs, and the caretaking agents of the community whose role is to help citizens in trouble.

Suggesting a number of avenues of explora-

tion, our formulations about large-scale preventive psychiatry should be tested by building up a body of knowledge concerning the range of adaptive and maladaptive problem-solving methods of individuals in regard to the more common crises, working out ways of integrating this knowledge within the professional framework of caretaking agents in the community, and developing an appropriate scheme for deploying the services of specialized psychiatric personnel in the most economical way to achieve community coverage.

### Family Studies

To advance research on certain aspects of our program, we have established a mental health unit in a Boston health center and have built up a collaborative working relationship among psychiatric and public health personnel.

We chose the family unit for study so that we may understand how the family as a group augments or weakens the problem-solving capacities of its individual members.

We chose as our main categories of hazardous circumstances three events in family life with which health workers deal routinely: prematurity, congenital abnormality, and tuberculosis. These categories have the advantage of being notifiable conditions and thus being easy to sample from health department lists.

Our study is still in the pilot stage. So far we have gained entry into 50 families and completed an intensive study of 15. Our families range from middle middle class to the lowest socioeconomic class.

In each case, the public health nurses and physicians continue their traditional services and also help us collect data. As early as possible after the impact of the crisis, they introduce our worker to the family. His first task is to enlist the cooperation of each member in the study and to obtain permission to visit them in their home once a week during the period of the crisis.

After the crisis is over, we carry out an indefinite followup of the study families at progressively longer intervals in order to assess the immediate and long-term results on their mental health.

We have discovered that the discussion of

problems is welcome in middle-class families but is often viewed as dangerous by families of low status. Our general approach is to interfere as little as possible with the stressful situation and with the family's method of dealing with it, but after the crisis is over we take on a more therapeutic role in order to strengthen our relationship and obtain information about deeper aspects of the family interactions.

We have found that valid information about crisis reactions can be obtained only while the crisis is in progress. We postpone obtaining background information on the historical development of the family until the pressure of the crisis has passed.

In our studies we have found it profitable to refer to two patterns of family functioning which may be significantly related to eventual mental health changes. These are the "family life style," meaning the reasonably stable pattern of family organization which leads to a range of problem-solving possibilities from which the family, individually or collectively, may choose according to their perception of the demands of the situation, and the "intermediate problem-solving mechanisms," which introduce dynamic forms of adjustment to the crisis.

Although the life styles of certain families may be conducive to mental illness, in many others the life style affords greater or lesser opportunities for mental health. Whether mental illness or mental health develops will be determined by what choices are actually made during crisis periods. The current factors influencing the choices are therefore significant.

During the period when the new solutions are being worked out, certain patterns can be recognized in which the tension is reduced for the family as a group but at the emotional expense of one or more individual members. Emotional exploitation of a family member invests him with a role which infringes upon his needs. In such cases we have observed that the emotional problem was not being adequately dealt with by the group because of poor leadership, disorders of internal communication, or other organizational inefficiencies. Emotional exploitation of an individual reduced group tension by allowing abreaction of anxieties or ventilation of guilt in relation to an object acceptable to the family's value system.

We are beginning to tease out the factors which cause a family member to be singled out for exploitation in this manner as part of the family's response to a crisis, and which consequently endanger that person's future mental health by frustrating his basic emotional needs.

## Social Work For the Family

**PHR** Not many years ago public health workers, physicians, and social workers learned about the family empirically without adequate theoretical formulations on which to base their practice. Today, there is an ever-expanding body of validated theory regarding the family to be tested in application.

Social workers see the family as the cornerstone of society and, therefore, the focus of their attention.

The bulk of present-day social work seeks to sustain families by providing food, clothing, and shelter. Only if such support seeks to enable the individual and the family to contribute in some measure to society is it compatible with the objectives of social work. It is vital for social agencies to be philosophically oriented and practically endowed to provide help that is not on a pennypinching, rockbottom basis.

### Professional Cooperation

Characteristically, the social worker operates where there are symptoms of family or social dysfunction. The social worker may know that a patient is well enough to go home and that the hospital needs the bed immediately, but may

also know that the family is not in condition to receive the patient.

For example, a boy of 9, a victim of cerebral palsy, was admitted to an institution for handicapped children. Although he was living on an infantile level, he was found to have normal intelligence. During his 2 years at the institution, he learned to feed himself, to use the toilet, and to make his needs known verbally, although his speech improved but little.

The boy's discharge was recommended when it was apparent that he could be treated as an outpatient. However, his mother was not prepared for, in fact, refused to accept, the improvement in his condition. Consequently, the boy regressed at home and probably will require institutional care again.

Hospitals and social agencies must continue to work together in many ways to counteract situations in a family unit which may undo the work of the hospital and physician.

### Group and Community Organization Methods

Social workers also use group work and community organization methods which strongly influence family health. The focus of such work is on larger social units, and provides recreational, creative, and citizenship outlets to promote the "pursuit of happiness."

Group interaction, peer relationships, and experience with authority and group leaders tend to produce changes in individual behavior which can be carried over from the immediate group, and the change is subsequently felt in family life.

I wish that public health workers had made more use of community organization skills during recent years in view of some of the roadblocks set up in segments of the community to the advances of medical knowledge. Their success in expediting therapy and release of tuberculosis patients, for example, had striking effects in the patients' families observed by social workers. There was an exacerbation of the anxieties and fears usually aroused by the return of a tuberculosis patient and an apparent prolongation of the period of readjustment.

The family accurately mirrors the community's stereotypes about the nature of contagion

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*By Virginia Bellsmith, M.S., professor of social work, New York School of Social Work, Columbia University, New York City.*

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reinfection, and disability in tuberculosis. Much more than the dissemination of educational material has to be provided if discharged patients are to be accepted by the community. Community social planning is needed. Unless community resources are realigned and augmented, patients can be isolated and house-bound.

The planned addition of social workers, with particular community organization skills, to the conventional health and welfare team might significantly alter community attitudes about tuberculosis and its victims and also modify community planning.

Similarly, the use of tranquilizers in mental illness and the mass application of poliomyelitis vaccines are other technological medical advances which require community cooperation for maximum acceptance.

### Social Phenomenon

Although in the last 10 years, social workers have attempted to examine systematically con-

cepts and formulations of social work, none of the completed studies have given attention to a phenomenon which social workers have noted in their records for many years, that some adults who make mature, healthy familial and social adjustments grew up in families characterized by gross pathology.

The fact that such growth occurs is variously ascribed to innate strengths in the individual, to hidden assets which counterbalanced deprivation and distortion in the family, or to the fact that we do not yet know enough about the relative significance of traumatizing familial experience in children at different stages of development.

More study of family processes would certainly add to our understanding of cause and effect in personality development. But an examination of the histories of such adults leads me to the belief that a systematic exploration of the importance of consistency and continuity of pattern in such families may provide new understanding about the basis on which healthy personalities and strong egos are built.

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## PHS Staff Announcements

Dr. Robert J. Anderson has been named chief of the Public Health Service's Communicable Disease Center, in Atlanta. He replaces Dr. Theodore J. Bauer, who has been appointed deputy chief of the Bureau of State Services in the Washington headquarters.

As assistant chief of the Division of Special Health Services in Washington for the past 2 years, Dr. Anderson has directed operational research in tuberculosis, chronic diseases, venereal disease, occupational health, and heart disease control activities.

Following his first service assignment in 1940 as health officer in Newton and Texas Counties, Mo., he entered tuberculosis control work and served in Philadelphia and San Antonio as tuberculosis control officer and later with the California State Health Department. He became chief of the Tuberculosis Control Division of the Service in Washington in 1948.

Dr. A. L. Chapman has been appointed chief of the Division of Special Health Services, replacing Dr. Seward E. Miller, who has been given leave of absence to accept a teaching and research position at the University of Michigan. Dr. Chapman has been medical director of the regional office of the Department of Health, Education, and Welfare in New York City.

Dr. Richard F. Boyd, now medical director in the San Francisco regional office, will move to New York City, replacing Dr. Chapman. Dr. Charles F. Blankenship, now medical director of the Kansas City regional office, will move to San Francisco, replacing Dr. Boyd.

Dr. Lewis H. Hoyle, formerly regional health services consultant at the Kansas City office, replaces Dr. Blankenship as medical director of the office.

# Public Health Service Announces New Program For Accident Prevention

THE NEW Accident Prevention Program of the Public Health Service, created July 1, 1956, is located in the Division of Special Health Services, Bureau of State Services. The program is directed by James L. Goddard, M.D. Chief of Program Services is Eugene L. Lehr, a sanitary engineer; chief nursing consultant is Jean F. Williams; and Albert P. Iskrant, a statistician, is chief of Operational Research.

Designed to serve State and local health departments through research, consultation, training, and information, the new program will devote much of the current year to planning in preparation for a considerably expanded operation in fiscal year 1958. In addition to its own staff, the program will use the services of personnel assigned by other interested agencies in the Department of Health, Education, and Welfare. A Departmental Advisory Accident Prevention Committee will help coordinate Departmental activities in the field.

Broadening the scope of the former home accident prevention program in the Bureau of State Services, the new program will, through use of the epidemiological approach, concern itself with the basic factors in accident causation and prevention and will enlist the competencies of all the disciplines in public health. The program will also assume responsibility for the former interests and activities of the Division of Sanitary Engineering Services in the hygiene of housing. Special attention will be directed toward developing guidelines and standards for incorporating basic safety and hygienic features into housing structures, including homes for special occupancy.

The accident category constituted the fourth leading cause of death in this country in 1955, and was actually the first cause of death for the age group 1-34 years. More than 90,000 persons died from accidents in 1955. More than 9,000,000 injuries are estimated to occur each year, causing more than 300,000 permanent impairments.

Since accidents are the result of forces from three sources—the host, the agent, and the environment—the public health procedure of epidemiological analysis, determination of causes, development of preventive measures, and evaluation may be applied in studies for preventing them.

Specialists from every field, including that of human behavior, can be used in the studies of the interrelationship of the forces and multiple causes that lead to accidental injury or death.

A 7-point work program has been set up as follows:

1. Collection and analysis of data.
2. Training (inservice, assignment, and formal).
3. Educational and informational services.
4. Experimental studies and epidemiological investigations.
5. Program demonstrations.
6. Consultation to official and voluntary agencies.
7. Aid to health departments in evaluating and setting up statistical procedures.

Other Departmental agencies cooperating with the new Accident Prevention Program are the Children's Bureau, Food and Drug Administration, Office of Education, and Office of Vocational Rehabilitation. Within the Public Health Service, the Bureau of Medical Services, the National Institutes of Health, the Division of Public Health Methods, and the National Office of Vital Statistics are all active in the work of the program.



# Progress in Reporting Mental Hospital Statistics

*Sixth Annual Conference of  
Mental Hospital Statisticians,  
Topeka, Kansas, April 26-28,  
1956*

THE STATISTICAL problems created by the widespread use of the tranquilizing drugs, comparisons of results of cohort studies, and measurement of degree of mental illness were major topics at the Sixth Annual Conference of Mental Hospital Statisticians. The conference, held at Topeka, Kans., April 26-28, 1956, was sponsored by the National Institute of Mental Health, National Institutes of Health, Public Health Service.

Delegates from the member States of the Model Reporting Area for Mental Hospital Statistics attended (see box inset). Washington was admitted as the 18th member State at this conference. In addition, unofficial observers from Massachusetts, North Dakota, and South Carolina, St. Elizabeths Hospital, Washington, D. C., and the Veterans Administration were present.

The Model Reporting Area for Mental Hospital Statistics was established in 1951 by mental hospital administrators and statisticians from 11 States. The organization's primary objective is to develop uniform procedures and definitions so that meaningful comparisons of mental hospital data among member States can be made. To meet the minimum requirements for admission a State (a) must have a central

statistical system to provide reporting from all of its State hospitals, (b) must have a professional statistician in charge of the statistical system, and (c) must agree to the definitions adopted by the Model Reporting Area and produce annually a minimum number of tabulations agreed to by the area States.

Dr. Morton Kramer, chief, Biometrics Branch, National Institute of Mental Health, opened the meeting by outlining some of the problems facing mental hospital statisticians. Among these, he mentioned the constant demand upon the statistician to justify current expenditures or to show the need for additional funds in view of the large mental hospital appropriations. He also discussed the importance of obtaining adequate data on the effect the increasing use of tranquilizing drugs is having on the Nation's mental hospital systems, and the need for controlled studies to test the effectiveness of these drugs.

## Studies on Tranquilizing Drugs

Five delegates indicated that reporting procedures had been developed in their State mental hospitals to determine the number of patients placed on drugs, the number remaining on drugs, and the number from whom the drugs had been withdrawn. These reporting systems are expected to provide the foundation data for future studies of the effectiveness of the drugs. Several delegates reported on current drug studies and those being planned, none of which,

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*Prepared by the Current Reports Section, Biometrics  
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tional Institutes of Health, Public Health Service.*

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however, involved the use of patients receiving placebos as controls.

Two basic difficulties for the statistician in his role in the studies of the drugs were raised: (1) All too often the statistician is called in to assist in a study after it has already been set up; and (2) frequently, the need for evaluation of such a program is not realized until long after the program has been in operation. In each the statistician is placed in a difficult position. He is often faced with the task of analyzing data obtained with inadequate experimental designs such as lack of control groups, or he may need information which is no longer possible to collect.

### Recommendation of Rating Scales

The Committee on Psychiatric Impairment, appointed at the 1955 Conference of Mental Hospital Statisticians, reported on its recommendations concerning the development of scales to quantify the degree of mental illness.

A major difficulty in interpreting release rates from mental hospitals (that is, the proportion of first admissions who are released within a given interval following admission) is that such rates may be influenced by the severity of the patient's illness. Two hospitals having vastly different crude release rates may have identical severity-specific release rates. Thus, observed differences in release rates among all first admissions can be caused solely by a difference in distribution of types of risks entering the two hospitals. It is important, therefore, to obtain some measure of the severity of illness in patients at the time they enter the mental hos-

pitals and at intervals after admission in order to permit meaningful interpretation of release rates.

The committee recognized this need, particularly for purposes of comparing hospitals or hospital systems. It recommended that the National Institute of Mental Health, through consultation with appropriate professional groups, such as the American Psychiatric Association and the American Psychological Association, evolve rating scales, that the States make trial application of such scales in measuring severity of psychiatric disorders, and that the National Institute of Mental Health provide consultation services and material aid to States in the trial use of these rating scales.

The committee also emphasized that the rating of patients be made at least at time of admission and release and at such other intervals as deemed advisable. The scales to be used should be reliable, valid, sensitive, simple of application, and useful statistically. These characteristics are defined as follows:

*Reliability*—the degree of uniformity with which severity can be measured by different observers.

*Validity*—the ability of the scale to give results consistent with generally accepted clinical judgments of severity.

*Sensitivity*—the scale should be a sensitive measure of change in degree of severity.

*Simplicity of application*—the scale should be easy to use with professional guidance.

*Statistical usefulness*—the scale should be amenable to statistical classification and analysis.

The committee recognized that other patient characteristics and environmental factors were associated with psychiatric impairment. It was further recommended that attention be directed to the relationship between somatic impairments, household and community factors, and the admission of patients to and their release from mental hospitals. The report of the Committee on Psychiatric Impairment was approved and accepted by the conference.

### Cohort Studies

At the 1955 conference, the Cohort Study Committee recommended that members of the Model Reporting Area conduct cohort studies of

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### Model Reporting Area States

Representatives from the following States are members of the Model Reporting Area for Mental Hospital Statistics.

Arkansas	Michigan	Oklahoma
California	Minnesota	Pennsylvania
Illinois	Nebraska	Texas
Indiana	New Jersey	Virginia
Kansas	New York	Wisconsin
Louisiana	Ohio	Washington

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first admissions to State mental hospitals. These studies were to include all first admissions during a period of 3 months or more and were to follow these patients through their hospital experience for 1 year or until death or the first significant release, in order to determine for specified intervals of time, the proportion of first admissions released alive or remaining or dying in the hospital.

During the year, 10 States performed such studies. They reported the gross results at the conference. The percentage of patients released alive within 1 year following admission ranged from 50 to 90.

More detailed comparisons were not possible because the categories used by the various States were not comparable. For example, different age groupings were used by various States and some had further refinements, such as by sex and diagnosis, while others did not.

In view of these difficulties a new Cohort Study Committee, consisting of a statistician and clinician from each of 5 States, was appointed to review the cohort data and the methods of analysis used by the 10 States mentioned above. Each State will be asked to submit cohort data in a uniform manner to allow meaningful comparisons.

The committee will review these studies and meet to consider possible interpretations of interstate comparisons, taking into account as many known factors as possible. The committee will then report to the next conference its recommended interpretations of these studies and, perhaps, suggest further refinements to yield more meaningful analyses.

#### **Uniform Financial Data**

The need for uniform financial data was emphasized in a discussion of costs per patient. States are continually comparing their per patient maintenance expenditures with those of other States in order to demonstrate to legislators and the public the need for increased expenditures. It was pointed out, however, that such comparisons of expenditure data are often not valid. Some of these variations which cause noncomparability were noted in (a) policy with respect to inclusion or noninclusion of building and improvement expenditures in

maintenance costs, (b) the effect of climate on fuel and utility costs, (c) and the effect of institutional farm operations on food costs.

To circumvent some of these problems in comparisons of expenditure data, it was proposed by one of the States that total man-hours for treatment of patients be classified according to personnel categories such as physicians, nurses, social workers, attendants, and so forth. Under this proposal salaries of these employees would be related to the cost of living index for that region. Thus, per patient expenditures for salaries would be computed and adjusted according to the prevailing cost of living index. Interstate differences in salary levels for a given employee classification, after adjustment for regional differences in cost of living, might indirectly reflect differences in the skill, training, and general quality of such personnel. No specific action was taken on this proposal by the conference.

This problem of per patient cost has assumed sufficient importance to be of major concern to the Council of State Governments. The council, meeting with budget representatives of various States to consider these problems, has made specific recommendations. One called for the Council of State Governments to obtain the definition of "capital outlay" as used by the Bureau of the Census and determine whether it should be modified for mental health purposes. Another suggested that the States compute two sets of maintenance cost figures if they have psychopathic hospitals, one set to include and the other to exclude the maintenance figures for psychopathic hospitals.

The conference appointed a committee, consisting of statisticians from five States, to meet with comparable committees of the Council of State Governments to develop standards for determining the composition of maintenance expenditures. The committee is expected to report its progress at the next conference.

#### **Other Problems**

Considerable concern was expressed by some regarding the present nomenclature for mental defectives. A draft of the nomenclature which is an extension of the standard nomenclature was presented by one of the States. This revi-

sion is being applied in that State on a trial basis only. The conference agreed that this is an area requiring further study. It was suggested that States, as they attempt to solve difficulties in nomenclature, keep all the other States informed.

Monthly reporting of a few items concerning movement of mental hospital patients was suggested by one of the States. The objective of such reporting would be to provide simple data for studying current trends in mental hospital admissions, separations, and resident patient populations. It was proposed that a draft of a form for such reporting be prepared and submitted to the National Institute of Mental Health for circulation to the Model Reporting Area States for consideration.

### **Regional Meetings**

The interest generated by these annual conferences has brought about the spontaneous

inauguration of regional meetings for mental hospital statisticians from neighboring States. Mutual problems, with special emphasis on interstate comparisons of mental hospital data, were considered. Since most States are interested in comparing data with neighboring States rather than with States far removed geographically, these meetings were felt to have been particularly helpful. Two such meetings were held in October 1955—representatives from 8 eastern States met at Princeton, N. J., and representatives from 7 midwestern States met at Chicago, Ill.

A questionnaire, requesting basic mental hospital data on a current basis, was developed and circulated by the midwestern group. The results were compiled, and a brief report on these comparative data was distributed. This report was found very useful by some of the States for presentation of material to their legislatures.

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## **Home Safety Inventory**

State health departments in 32 of 48 States participating are headquarters for the 1956 Home Safety Inventory sponsored by the National Safety Council. Public health agencies are represented in State safety councils serving as inventory centers in the 16 other States.

The basic purpose of the inventory is to help participating agencies let one another know what each is doing to prevent home accidents.

Local health departments will receive inventory forms in December from the State inventory centers. The value of the inventory will depend on how effectively local health departments complete and transmit the forms and report home safety activities of the past year. The information will be analyzed by punchcard devices. Duplicates of the completed forms will be given each participating State health department.

# California's Experience in Training Public Health Physicians

By GEORGE T. PALMER, Dr.P.H., and MALCOLM H. MERRILL, M.D., M.P.H.

IT IS a well-accepted principle today that people entering the field of public health should have specialized training. Sedgwick at the Massachusetts Institute of Technology, Vaughan at the University of Michigan, and Abbott at the University of Pennsylvania were pioneers in establishing teaching centers for this purpose as far back as 1890.

Sedgwick's early work was focused principally on the field of microbiology and sanitary science. At that time and, in fact, for many years thereafter, there was doubt in the minds of some as to whether the medically educated worker really needed additional training in public health practice. Gradually, however, it became evident that the scope of a medical health officer's work went well beyond the field of medicine. Knowledge was also required in the fields of engineering, environmental sanitation, vector control, health education, social problems, community leadership, public administration, and laboratory sciences as related to public health as well as other fields.

In order to meet the growing need, schools of public health grew in number and in the scope of instruction offered. Through the years it has become increasingly evident that so far as medical health officers' training is concerned the limiting factor has been the provision of candidates for training. Recruiting of physicians

was materially facilitated, though not solved, with the provision of Federal funds for scholarships. These funds became available in California in 1936. The following report summarizes the experience in the training of physicians in California since that time.

## Background of Study

During the period from September 1936 through June 1954, 86 physicians were granted scholarships by the California State Department of Public Health for the 8 or 9 months' course in a school of public health leading to the degree of master of public health. In a very few instances, field training in a local health department was provided for an extra period of 3 months. And in a few instances the scholarship was granted after the beginning of the term and thus did not cover the full period of 9 months.

Training was carried on for the 6 years 1936 through 1941, and then was discontinued during the war years of 1942 through 1945 because of lack of candidates. The scholarship program was renewed in 1946 and has continued without interruption to date. However, no candidates were available for the academic year 1952-53. Thus, this review represents 13 training years.

Omitted from the tabulations that follow are 12 physicians, the 6 who completed training in June 1955 and another 6 who concluded training in June 1956. All of these were promptly placed in local health departments in California.

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*Dr. Palmer is consultant in public health training and administration and Dr. Merrill is director of the California State Department of Public Health.*

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**Table 1. Years served in public health or related field by physicians whose training was sponsored by the California State Department of Public Health, September 1936-June 1954**

Number of trainees, field, and length of service	In California June 1954	Have been in California but not present June 1954	Never in California	Total	Percentage distribution of total possible years of service less death years
Number of trainees.....	49	34	3	86	
Government service years:.....					
In California.....	432	174	0	606	68
Other States.....	3	31	25	59	7
Foreign service.....	6	8	5	19	2
Military service.....	20	36	0	56	6
Total government service.....	461	249	30	740	83
Nongovernment service years:.....					
Private practice.....	4	126	0	130	15
Other fields.....	1	18	0	19	2
Length of service:.....					
Maximum possible service years.....	466	434	30	930	
Years lost through death.....	0	41	0	41	
Maximum possible years less death years.....	466	393	30	889	
Maximum length of service in California per trainee.....	18	15			
Minimum length of service in California per trainee.....	1	1			
Average years per trainee:.....					
In California.....	8.8	5.1			
In total government service.....	9.4	7.3	10.0	8.6	

The gathering of the basic data has been difficult and time consuming owing to the inadequacy of complete detailed records for the period prior to 1947. We drew on the knowledge of workers long with the State health department and made extensive inquiries of trainees through correspondence. However, accuracy in all particulars cannot be assured. In assembling costs of scholarships, we used the amount prevailing at the particular period when the specific individual amounts were not definitely at hand. The figures used, we believe, are a fair estimate.

### Services After Training

A study was made of the subsequent history of employment of the 86 physicians who received training under the program. Special attention was given to determining the number of years after training that each physician continued in full-time public health work, both in California and elsewhere (table 1).

Still in public health or related public health services in California are 49 of the 86 trainees. The term "related" refers to employment other than in health departments, such as teaching

in schools of public health or universities or work in various voluntary health agencies or public health associations.

Since receiving training, some of the 49 physicians who were engaged in public health work in California in 1954 have been in health service for one or more years in other areas of the country or in foreign or military service or in private practice.

All but 3 of the 86 have at some time since training spent one or more years in public health or related service in California. There has been an understanding between the scholarship recipient and the State health department that upon completion of training the trainee would accept a position in a California health department and remain in this type of employment for a minimum period of 2 years. The three who have not done so have given justifiable reasons, such as unexpected family circumstances, illness, or compelling calls to foreign service. In one of these instances, the entire amount of the scholarship was repaid to the State.

In addition to the 49 employed in California in 1954 and the 3 mentioned above, 34 trainees who were employed elsewhere in 1954 or who

had died (4 in number) had previously spent a total of 174 years in California service.

Altogether, the 86 trainees have spent 606 years in health service in California, 59 years in health service in other areas of the country, 19 years in foreign service, 56 years in military service, 130 years in private practice, and 19 years in other fields of work.

The total possible years of service (18 years per person for those finishing their training in 1937, 17 years for those finishing in 1938, and so on) is 930. However, 41 years must be deducted for years lost through premature death, thus converting this figure to 889 years.

The 606 service years spent in public health or work related to public health in California represent 68 percent of the 889 possible years. However, if to the 606 years are added the service in other States, foreign, and military service, 740, or 83 percent, of the possible 889 years were spent in government service.

Of the 15 percent of total possible years spent in private practice, it may be said that, although not spent in strictly public health service, undoubtedly there were substantial and worthwhile gains in an understanding cooperation with public health services stemming from the active years spent in this field.

Of the 18 trainees in private practice in 1954, 16 received their public health training prior to 1942. Only two trainees in the training period from 1946 on were in private practice in 1954.

### Cost of Training

The average cost of a scholarship for the 86 physicians during the 13 years of the program

was \$2,910 per person (table 2). Excluded from this sum are operating and administrative costs. The largest item was for stipends, or living expenses, which amounted to about \$222,700. The approximate total for tuition was \$17,300 and for travel, \$10,000. The total is thus about \$250,000. For this sum, the taxpayers have already received 740 man-years of professional medical public health service. This length of service represents an average cost per trainee of approximately \$338 per year thus far. The figure will decrease, of course, as the years of service increase.

The financial support of the training program for physicians, as well as for other professional personnel not here indicated, has come from Federal funds throughout the entire period with the addition of State funds for the 2 years 1948-49 and 1949-50.

The cost of scholarships have varied considerably over the years. This has been due to a number of changing circumstances, including changes in amount of scholarship allowance reflecting economic changes; the location of the training school, with higher travel and tuition costs for eastern schools; and the change in policies in later years whereby costs in eastern schools were limited to the equivalent of the California school.

The 86 physicians received their training in 8 universities as follows:

California	46	Michigan	4
Harvard	17	Minnesota	2
Johns Hopkins	10	Columbia	1
Yale	5	Vanderbilt	1

It is of interest to note the wide participation of schools of public health throughout the coun-

Table 2. Scholarship costs for physician training in public health

School years	Number in group attending school			Approximate average cost per trainee <sup>1</sup>			
	In California	Outside of California	Total	Stipend	Tuition	Travel	Total
1936-38	21	0	21	\$1,770	\$55	0	\$1,825
1939-41	1	26	27	1,860	330	\$230	2,420
1946-50	18	13	31	3,630	215	125	3,970
1951-53	6	1	7	3,230	65	5	3,300
Total	46	40	86				

<sup>1</sup> Average for entire group, \$2,910.

try in contributing to the education of California scholarship students.

## Discussion

It is believed that the money invested by government in the training of public health physicians in California has been a most valuable investment. While only 68 percent of the 889 possible years of service were spent in public health in California, it is significant that 83 percent of the possible years were spent in government service, either within or outside continental United States. Since the funds were derived primarily from a national source, it is not unreasonable to include service in the general public health field as representing returns on the investment. Taking this into consideration, the average cost to government per year of service of the medical officers covered in this study has been approximately \$338 for the 740 man-years to date. When it is considered that in the California public health situation physicians thus trained are for the most part responsible for the administration of State and local public health programs involving the expenditure, at present, of between \$40 and \$50 million annually, the true significance of the government's investment in training is apparent.

Most of the physicians leaving the public health field were trained prior to 1946. This loss occurred during the unsettled conditions of World War II with the resulting intensification of competitive bidding for the services of these physicians. Since the 1946 period, there has been a distinct change in the status of the public health profession, the development of the Specialty Certification Board in Preventive Medicine, and more attention on the part of the public to provision of better salaries for career public health physicians. The stabilization of public activities has contributed to making a career in public health more attractive as a continuing profession for physicians once they are recruited into the field.

Recruitment, however, is still a difficult problem. The limited number of available scholarships is a vital restriction. In California, for example, with due regard for the training of other professional personnel, there are but six

scholarships per year currently available for physicians. It is estimated that at least 10 physicians will need to be trained annually in order to take care of replacements and expanding public health activities in the State.

It is becoming increasingly evident that the only way sufficient physicians can be recruited to the public health profession will be through the provision of a planned program of training that will carry them through the academic year of postgraduate education in public health plus 1 year of residency in an approved health department. With this background they will find employment opportunities that will add 1 year of supervised field experience in public health and 8 years of public health practice. After completing these 6 years of training and experience in preventive medicine and public health, physicians will be eligible for certification by the American Board of Preventive Medicine.

## Summary

1. Since 1936, 86 physicians have been granted scholarships by the California State Department of Public Health for academic training in public health.

2. Of these 86 physicians, 49 are still engaged in full-time public health or related public health work in California, and 34 others have been at some time in public health work or related service in California.

3. Of the 889 possible years since completing training, the 86 trainees have devoted 740 man-years, or 83 percent, of the possible years in government service; 606 of these service years have been spent in public health or related work in California.

4. The total cost for training the 86 physicians has been \$250,000. If spread over the subsequent years of service in the public health field until June 1954, this amount represents a cost of approximately \$338 per year of service.

5. Eight different schools of public health were utilized in the training of these candidates.

6. It is concluded that this has been a sound investment on the part of government.

7. The need for further extension of this type of training program is indicated.



# Etiology of 1954-55 Poliomyelitis Epidemic in Puerto Rico

By DAVID H. NAIMARK, M.D., and NANCY G. ROGERS, B.A.

**D**URING the latter part of 1954, paralytic poliomyelitis appeared in epidemic form on the island of Puerto Rico. This epidemic became one of the largest outbreaks of poliomyelitis in the recorded history of the island with some 500 cases reported from November 1954 through June 1955.

At the request of the Secretary of Health, Commonwealth of Puerto Rico, plans were made early in December 1954 for viral studies on a representative group of pediatric patients. The laboratory data obtained from this study during the height of the epidemic supplements a preliminary epidemiological report (1).

## Methods

Cases of paralytic poliomyelitis admitted to the pediatric service of Bayamon District Hospital in Puerto Rico relatively soon after onset of their disease were chosen for study. The hospital staff selected 16 patients, ranging in age from 1½ months to 7 years, collected the appropriate specimens, and prepared case summaries. Materials for collection of specimens

were supplied by the Tropical Research Medical Laboratory, United States Army, San Juan, Puerto Rico. The responsibility for handling, storing, and shipping specimens fell to this same installation. Diagnostic laboratory studies for poliomyelitis were performed by the Department of Virus Diseases, Walter Reed Army Institute of Research, Walter Reed Army Medical Center, Washington, D. C.

Initial blood samples were drawn shortly after hospital admission, and subsequent specimens were taken on the 14th to 21st days of disease. Throat and rectal swabs were obtained during the first few days of hospitalization. In fatal cases, generous blocks of tissue were taken from several areas of the brain in addition to a portion of the cervical spinal cord.

Blood drawn in Keidal vacuum tubes was stored overnight at 4° C. Serum was then separated from the clot and maintained in the frozen state until used for serodiagnostic procedures. Throat and rectal swabs were individually placed in sterile screw-capped tubes containing 1 milliliter of veal infusion broth. These were promptly frozen and maintained at -70° C. (dry ice) until thawed for tissue culture inoculation. Central nervous system tissues were aseptically removed at time of autopsy, placed in tightly sealed (screw cap) wide-mouth bottles, and also stored at -70° C. Materials thus collected, and accompanying clinical and laboratory summaries, were periodically shipped in dry ice via air express to the

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Walter Reed Army Institute of Research for laboratory study.

Serums were tested for neutralizing antibodies against the three types of poliomyelitis virus by a modification of the tissue culture metabolic inhibition procedure described by Salk and associates (2). The test, as performed, contained serial twofold dilutions of the patient's serum, approximately 100 to 300 tissue culture ID<sub>50</sub> (3) of one of three prototype poliomyelitis viruses (Mahoney, type 1; Y-SK-7, type 2; and D-3-83, type 3), and a suspension of trypsin-dispersed monkey kidney epithelial cells (4).

For attempted isolation of virus, broth suspensions of throat and rectal swab specimens were first centrifuged at 2,000 r.p.m. for 30 minutes. The supernatant fluids were treated with sufficient penicillin and streptomycin to bring the final concentration to 1,000 units and 1,000 micrograms per milliliter, respectively. After incubation from 30 minutes to 1 hour at room temperature, individual suspensions were inoculated in 0.1 milliliter amounts into each of 2 or 3 tubes containing tissue cultures from monkey kidneys. Blocks of central nervous system (CNS) tissue from the various anatomical areas were pooled, made into a 20 percent suspension with chilled distilled water, and then processed and inoculated as above.

Inoculated tissue culture tubes were observed daily for microscopic evidence of cytopathogenic effect. If no degeneration was seen after 14 to 21 days, one blind passage of cells and fluid was made and these subcultures observed

for a similar period of time. When definite signs of specific cellular degeneration occurred, the tissue culture fluid was harvested and inoculated into a "spot neutralization typing test" as described by Melnick and others (5). In this procedure, samples of infected "unknown" fluid were mixed separately with poliomyelitis type-specific monkey hyperimmune serums. Following incubation, these mixtures were each inoculated into two tissue culture tubes and incubated at 37° C. for several days. Preliminary identification was accomplished if protection occurred in the tubes containing one monotypic antiserum but not in the tubes containing the other two antisera or in the control cultures. In each instance, the procedure promptly identified the cytopathogenic isolate as a strain of poliomyelitis virus, and it was unnecessary to perform quantitative neutralization tests.

Specimens from the 16 patients studied were obtained during December 1954 and January 1955. Nine of these patients died while the seven survivors exhibited definite paralytic manifestations. All 16 patients lived within a 10-mile radius of the hospital, but several cities were represented; 7 resided in Toa Baja, 5 in Catano, 3 in Bayamon, and 1 in San Juan.

## Results

Virus isolation attempts using central nervous system tissue were successful in 6 of the 9 fatal cases, with recovery of type 1 poliomyelitis virus in each instance (table 1).

Throat and rectal swab materials were avail-

Table 1. Poliomyelitis virus isolations from 9 fatal cases

Patient No.	Patient's age	Results of virus isolation attempts on.		
		CNS	Throat swab	Rectal swab
1	1½ years	Type 1	Negative	Negative.
2	1½ months	Type 1	Negative	Negative.
3	1½ years	Type 1	Negative	Negative.
4	16 months	Type 1		
5	2½ years	Type 1		
6	1 year	Type 1		
7	4½ years	( <sup>1</sup> )		
8	10 months	Negative		
9	3 years	Negative		

<sup>1</sup> Results unsatisfactory because of bacterial contamination.

NOTE: Leaders (—) indicate swabs were not available.

Table 2. Poliomyelitis studies of 7 surviving (paralytic) cases

Patient No.	Patient's age	Results of virus isolation attempts		Neutralizing antibody titer against type: <sup>1</sup>		
		Throat swab	Rectal swab	1	2	3
10.....	5 years.....	Negative.....	Type 1.....	64	<4	<4
				128	<4	<4
11.....	16 months.....	Type 1.....	Negative.....	64	<4	<4
				128	<4	<4
12.....	1½ years.....	Negative.....	Negative.....	128	<4	<4
				512	<4	<4
13.....	7 years.....	Negative.....	Negative.....	16	1024	1024
				64	256	256
14.....	3½ years.....	Negative.....	Negative.....	<4	8	32
				32	<4	32
15 <sup>2</sup> .....	8 months.....	Negative.....	Negative.....	256	<8	<8
16 <sup>2</sup> .....	8 months.....	Negative.....	Negative.....	32	<4	<4

<sup>1</sup> Upper row represents tests with acute phase serum; lower row represents convalescent phase serum.

<sup>2</sup> Single serum samples only were available.

able from 3 of the patients who died and from all 7 surviving patients (tables 1 and 2). In only two instances were isolation attempts successful with these specimens; one strain was obtained from rectal swab material and another from a throat swab. Each of the two agents proved to be type 1 poliomyelitis virus (table 2). Although throat and rectal swabs failed to yield virus in the three fatalities, viral recovery was possible when CNS tissue specimens were used.

Paired serums were available for 5 of the 7 paralytic patients (table 2). Serologic tests revealed a significant rise in neutralizing antibody titer (fourfold or greater) in 3 of these instances (patients 12, 13, and 14). Although no significant increase in antibody was shown with the remaining two paired serums (patients 10 and 11), it should be noted that only type 1 antibody was present, and in each case a type 1 virus was recovered from either the rectal or throat swab. Convalescent serums only were obtained from the remaining two paralytic patients. Both were 8-month-old infants and their serums neutralized type 1 but not types 2 or 3 poliomyelitis virus.

#### Discussion

All 6 of the 9 fatal cases from whom virus was recovered from the CNS died by the third day of hospitalization, which was still within a few days following onset of illness. Two of

the three patients from whom isolation attempts were unsuccessful died relatively late in their illness (one on the 21st and the other on the 57th day of disease). The one remaining CNS specimen was considered unsatisfactory for study because of heavy bacterial contamination. In all nine of the fatal cases microscopic examination of brain and cord tissue resulted in a pathological diagnosis of poliomyelitis. (Gross and microscopic pathological examinations were done under the supervision of Dr. Gerardo B. Polanco, Bayamon District Hospital). It is of course not surprising that no virus could be recovered from the two patients dying late in the course of the disease since general experience has shown that virus can rarely be recovered from the CNS after the second week of disease (6).

It is of some interest that isolation attempts were successful in only two instances with throat and rectal swab specimens although presumably all such samples were taken from paralytic poliomyelitis patients. One must consider the possibility that the nasopharyngeal secretions contained little or no virus or perhaps neutralizing antibodies when these samples were obtained; yet, no such explanation suffices for the rectal swabs. More plausible explanations are, perhaps, that only small amounts of throat secretions or fecal materials were obtained thus causing virus dilution to be a critical factor (1) or viral inactivation

occurred in the tubes of broth under conditions of subsequent handling and shipment (2), or both. These observations appear in general agreement with those of Godenne and Riordan in a recent publication (7). They noted that throat and rectal swabs were not ideal specimens for routine poliomyelitis virus isolation attempts.

Demonstration of a significant antibody titer rise between paired serum specimens enabled a diagnosis in three surviving patients. The four remaining surviving patients were shown to possess neutralizing antibodies for type 1 virus alone. This assumes additional significance when one considers that each was convalescing from an attack of acute paralytic disease, and furthermore, in two such instances the children were less than 1 year of age.

### Summary

Type 1 poliomyelitis virus was isolated from 6 of 9 patients who died and from 2 of 7 survivors studied in the 1945-55 outbreak of acute paralytic disease in Puerto Rico. A diagnostic increase in neutralizing antibody titer for type 1 virus was demonstrated in 3 of the 7 surviving

patients, while the remaining 4 possessed antibodies for this type virus alone.

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## National Advisory Council on Health Research Facilities

Marion B. Folsom, Secretary of Health, Education, and Welfare, has appointed 12 members to the new National Advisory Council on Health Research Facilities. The council assists the Public Health Service in administering a program of Federal grants for construction of medical research facilities.

The advisory council, established in the new law, includes 8 leading medical, dental, and scientific authorities and 4 members to represent the public. The Surgeon General of the Public Health Service and an official of the National Science Foundation are ex officio members, with the former serving as chairman.

Members of the council are: Dr. George N. Aagaard, Seattle, Wash., professor of medicine and dean of the University of Washington School of Medicine; Eugene N. Beesley, president, Eli Lilly and Co., Indianapolis, Ind.; Dr. Thomas H. Hunter, dean, University of Virginia School of Medicine,

Charlottesville; Dr. Carlyle Jacobsen, executive dean for medical education, State University of New York.

Dr. Paul C. Kitchin, professor of dental histology and embryology, Ohio State University School of Dentistry, Columbus; Dr. Oliver H. Lowry, dean, Washington University School of Medicine, St. Louis, Mo.; Dr. Robert A. Moore, vice chancellor, University of Pittsburgh; F. C. Sowell, vice president and general manager, radio station WLAC, Nashville, Tenn.

Dr. John E. W. Sterling, president, Stanford University, Calif.; Dr. Thomas B. Turner, professor of microbiology, School of Hygiene and Public Health, Johns Hopkins University, Baltimore; Dr. James W. Wilson, professor and chairman, department of biology, Brown University, Providence, R. I.; and James Bradshaw Mintener, former Assistant Secretary of Health, Education, and Welfare.

*How much of each lot of vaccine must be tested to provide reasonable assurance of its safety? This paper considers some of the statistical issues associated with this question and, in the process, develops the concept of the consistency of a production process.*

## Some Statistical Aspects of Safety Testing the Salk Poliomyelitis Vaccine

By JEROME CORNFIELD, MAX HALPERIN, Ph.D., and FELIX MOORE

MANY circumstances can influence the safety of any lot of vaccine. They may be conveniently considered as falling into two distinct classes. The first consists of all those circumstances affecting the ability to produce a safe vaccine, the second those affecting the ability to detect an unsafe vaccine. Problems involving the second class of circumstances we shall refer to as problems of safety testing. In practice the safety of the vaccines released for general use will depend on the successful solution of both sets of problems, and it would be hazardous to place reliance for safety exclusively on either one of the two. Nevertheless, in formulating criteria for safety testing, it is useful to inquire into the amount of testing re-

quired to assure a high level of safety without making any assumptions about the safety of the production process. This is equivalent to asking whether it is possible to assure a high level of safety by testing alone, even under the most unfavorable production circumstances that one can envisage. While we shall not be able to answer this question definitively, it will be because of the lack of key biological information and not because the problem is analytically insoluble or even necessarily that the solution, given the key information, would require impracticably large amounts of testing.

### Vaccine Preparation

We begin by reviewing briefly those aspects of vaccine preparation and the minimum requirements for safety testing (1) which are pertinent to the subsequent discussion. There are three immunologically distinct forms of poliomyelitis virus. An attack by type 1 virus will confer immunity against further infection by that type but not necessarily against infection by type 2 or type 3. Since the vaccine must provide protection against all three types, it must contain antigens for each. A vaccine prepared from a single virus type is referred to as a single-strain vaccine, while a trivalent

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vaccine, the form in which the vaccine is actually used, is a combination of equal amounts of three single-strain vaccines.

Each batch of single-strain vaccine is prepared from a virus pool obtained by propagation on cultures of monkey kidney tissue. The pool is filtered and then tested for infectivity. If sufficiently infective for tissue culture, it is ready for the next step, the preparation of vaccine. A pool is considered sufficiently infective if 0.5 cc. is capable of infecting tissue culture after at least a one-millionfold dilution. The amount by which a preparation must be diluted before it loses infectivity is referred to as its titer. There is, in fact, no single dilution point at which infectivity turns abruptly to noninfectivity, and in practice the titer used is that dilution estimated to result in infectivity for 50 percent of the inoculated tissue culture tubes. The amount of virus present in an inoculum capable of infecting 50 percent of the tubes is referred to as one tissue culture infectious dose (TCID<sub>50</sub>).

In practice it is more convenient to work with log titers than with titers. We thus say that a virus pool is ready for the next step when its log titer is at least 6. In the next step the pool is exposed to formaldehyde at a temperature of 37° C. and heated for 6 days or more. The preparation loses infectivity continuously but still retains the ability to stimulate antibody production. At intervals during this inactivation process samples are taken and the titer of 0.5 cc. determined. At some point during the process, usually 2 to 3 days, the titer has dropped from at least 1 million to unity, that is, after 2 to 3 days the 0.5 cc. of the preparation, if diluted at all, will infect less than half the tubes into which it is inoculated. Unless one uses larger inoculums or concentrates the preparation, the log titer cannot be easily determined for any period after this time. The curve relating log titer to time heated is referred to as an inactivation curve.

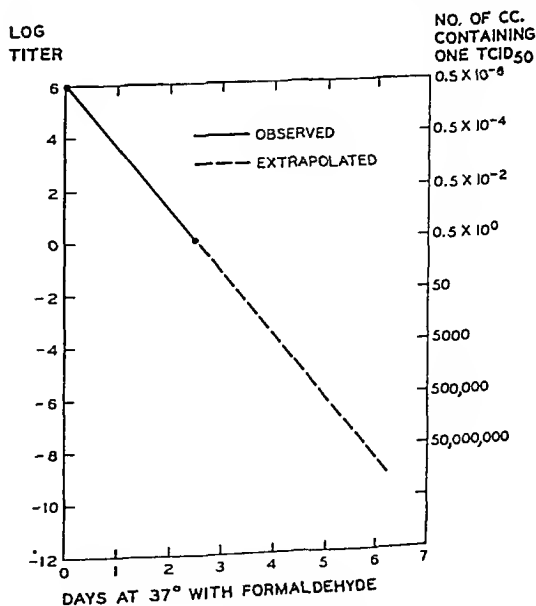
Subsequent to theoretically complete inactivation, tissue culture safety tests are performed. The current tissue culture safety test requires two independent tests of 500 cc. each for each single-strain vaccine, the first test 6 to 9 days after the initiation of inactivation, the second 3 days after the first. In addition, 1,500 cc. of

each trivalent vaccine must be tested. The test batch is passed if it produces no tissue changes indicative of the presence of live virus and in addition passes a monkey safety test. This latter test requires that each filling of the final trivalent lot must be tested on at least 5 monkeys, a minimum of 20 being used for each lot. Each monkey receives 2.5 cc. of vaccine. The lot is passed if histological and other studies on the test monkeys "leave no doubt that poliomyelitis infection did not occur" (1).

### Shape of Inactivation Curve

To point up the difficulties that can arise when exclusive reliance is placed upon the safety of the production process rather than on the adequacy of the safety test, we consider Salk's original concept of factors affecting safety. As elaborated in several publications, the chief guarantee of the safety of the final vaccine was not felt to be the result of a monkey or tissue culture safety test but rather the nature of the inactivation process itself. Thus, it was observed that if log titer was plotted against time of exposure over the observable period, that is, the first 2 or 3 days, that log titer was a linear function of time. Figure 1, which has been adapted from one of the discussions of

Figure 1. Theoretical relationship between log titer and inactivation time.

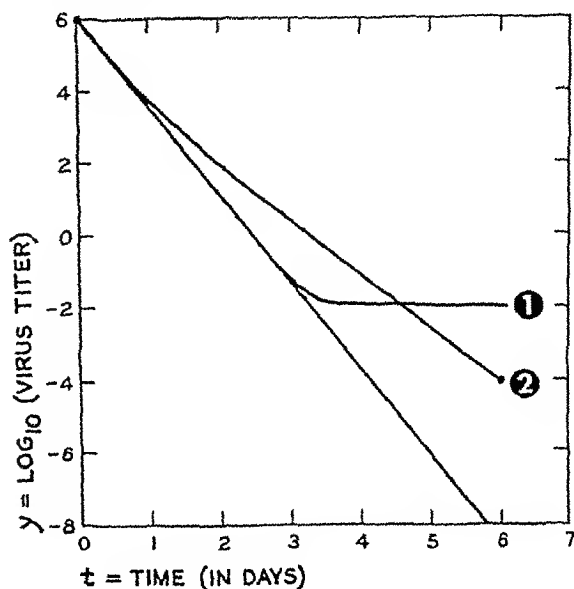


this point subsequently published by Salk (2), illustrates this point with a theoretical inactivation curve in which log titer is assumed to drop from an initial value of 6 to 0 in  $2\frac{1}{2}$  days. Salk has written (2) that the linear nature of this relation "makes possible the prediction, rather precisely, of the time required to render each preparation free of living virus." Thus, in the initial virus pool one tissue culture infectious dose could be found in as small amount as one two-millionths of a cubic centimeter. By  $2\frac{1}{2}$  days one would find one TCID<sub>50</sub> only in every half cubic centimeter, and, by simple extrapolation, by 6 days only one in every 125 million cc. Again quoting from one of Salk's publications (3) "[if] the reaction is allowed to proceed for a total period equal to three times the interval required for interception of the base line . . . the margin of safety which guarantees absolute safety has been assured."

The assumption that log titer was a linear function of inactivation time was not an entirely empirical one, simply suggested by inspection of data, but a relationship often found in theoretical chemistry. If the inactivation process is thought of as a chemical reaction analogous to a situation wherein one molecule of virus combines with one molecule of formaldehyde, the latter being present to excess and consequently not limiting the speed of the reaction, then the relationship between log titer and time would indeed be linear, if the system was homogeneous (4). Whatever the merits of this formulation from the point of view of inactivation kinetics under controlled laboratory conditions, the occurrence of lots of vaccines containing live virus, even after 9 days of inactivation (5), indicated that extrapolation of the inactivation curve was no substitute for safety testing.

It is not hard to see why the extension of results possibly applicable in a homogeneous system to a potentially heterogeneous system might cause difficulty. Thus, figure 2 compares the inactivation curves obtained for two different hypothetical heterogeneous systems with the linear inactivation curve of the preceding figure. In the first curve we have assumed a heterogeneous system with two groups of virus particles, each being inactivated at different rates. One group is assumed to have an initial titer of  $10^6$  and a loss of log titer of 2.4 per

Figure 2. Theoretical virus inactivation curves for three different models of the inactivation process.



day, the other an initial titer of  $10^{-2}$ , but it is assumed to have no loss in activity as the reaction proceeds. Such a situation could occur if the bulk of the virus particles were being inactivated as in a monomolecular reaction, but a small fraction,  $1/1,000,000$ , were protected from the action of the formaldehyde by tissue particles. It will be noted that in such a situation the observed inactivation curve would be virtually indistinguishable on any basis from a linear inactivation curve for the first  $2\frac{1}{2}$  days, but that thereafter it would level out quite rapidly and, no matter how protracted the time of inactivation, would remain at a level of one TCID<sub>50</sub> for every 50 cc., a highly infectious level. The shape of the inactivation curve for the observable period would in such a situation provide no guide to the subsequent course of the reaction.

In the second curve we have also assumed two groups of particles being inactivated at different rates. The first group is assumed to have an initial titer of  $10^{5.97}$  and to undergo a loss in log titer of 2.4 per day. The second group is assumed to have an initial titer of  $10^{4.51}$  and to undergo a daily loss in log titer of 1.47. Some curvature in the observable period will be noted. After 2 days of inactivation this curve is 0.8 of a log titer above the first curve, but it does not

level off as rapidly, eventually crosses it, and at 6 days has one TCID<sub>50</sub> in every 5,000 cc. Looking only at the observable period, one might place confidence in the eventual noninfectivity of the hypothetical vaccine producing curve 1 and might have serious doubts about the one producing curve 2. Nevertheless, after 6 days of treatment the second vaccine would have only 1/100 the concentration of infectious particles of the first.

These are, of course, only highly oversimplified models of what might happen. The real question is what does happen. To answer this we consider five successive lots of vaccine produced by a single manufacturer. These lots were composed of 104 independently produced and tested single-strain components. Of these, 12 had failed their initial tissue culture test after inactivation was presumably complete and the remainder had passed. We have taken all 12 of the positive components and a haphazardly selected sample of 17 of the 92 negatives. Least squares parabolas have been fitted to each of the 29 inactivation curves. The following tabulation shows for each of the curves the value of the quadratic component at 50 hours for positive and negative lots.

Negative lots		Positive lots	
1. 22	0. 66	1. 25	1. 86
1. 82	0. 10	0. 38	0. 22
1. 41	0. 59	0. 85	1. 16
0. 87	0. 63	-1. 59	1. 34
1. 84	0. 28	0. 94	0. 47
-1. 25	0. 57	0. 21	0. 85
0. 07	1. 16		
2. 00	0. 91	Average... 0. 66	
-0. 11			
Average... 0. 75			

NOTE: The quadratic component is the value of  $ct^2$ , with  $t=50$ , where  $\log \text{ titer} = a + bt + ct^2$  and  $t$  is time in hours.

It will be noted that the value of the quadratic component is less than zero in only three cases, two for negative lots and one for a positive lot. In all other cases the quadratic term is positive, indicating that the best fitting parabola curves up and away from the linear component and that a linear extrapolation will underestimate log titer. The average value of the component at 50 hours, 0.75, involves about the same departure from linearity at that point as does curve 2 of figure 2. The antilog of this value, 5.6, indicates that at 50 hours a difference of

more than fivefold in estimated titer had already developed between the best fitting parabola and its linear component.

The fundamental point, however, is that no difference is apparent in the value of the quadratic component for positive and negative lots. Theoretical considerations and actual experience both lead to the same conclusion therefore—that the shape of the inactivation curve up to a certain point provides no necessary indication of its shape thereafter. One can also draw the more general conclusion that no matter how safe a production process is believed to be, common prudence requires safety testing procedures which have high probability of detecting the presence of live virus particles, if by some unforeseen chance the production process permits this to happen.

### Size of Test Batch

In many problems of industrial sampling inspection, a decision as to how much to sample is reached by minimizing the monetary loss arising from a combination of testing cost and the costs arising from erroneously rejecting good lots or accepting bad lots of a product (with due regard for the a priori probability that a lot will be bad) (6). But in the present problem the loss arising from erroneously accepting an infectious lot is entirely incommensurable with the cost of testing or with the cost of erroneously rejecting good lots. This suggests that the methods of industrial sampling inspection cannot be applied to the present problem without some modification if they can be applied at all.

We may approach a solution by considering first of all an idealized suspension of virus particulates of which we may assume that (5):

1. The particulates are randomly and independently dispersed throughout the suspension.

Second, we consider an idealized test system for which we may assume that:

2. One particulate is an effective dose and when introduced into the test system will invariably make its presence known by eliciting some characteristic response.

Since our immediate interest is the logical structure of the problem of safety testing, we



defer to a subsequent section a discussion of the correspondence, if any, between (a) the idealized viral suspension and an actual vaccine containing residual live virus and (b) the idealized test system and the tissue culture and monkey tests actually used. In this and the following section the "lots" referred to are assumed to have the characteristics of this idealized suspension.

The first assumption is sufficient to assure that if a test volume of  $v$  cubic centimeters is taken from a suspension containing  $m$  particulates per cubic centimeter (infection level  $m$ ) the probability that the sample will contain exactly  $x$  particulates is given by the general term of the Poisson distribution, namely:

$$e^{-mv} \frac{(mv)^x}{x!} \quad [1]$$

This is true when the volume of the suspension ( $V$ ) is large relative to the volume of test sample ( $v$ ), as we shall assume in what follows. When this assumption cannot be made (7), the required probability is the general term of the binomial distribution, namely:

$$\binom{mV}{x} \left(\frac{v}{V}\right)^x \left(1 - \frac{v}{V}\right)^{mV-x} \quad [2]$$

The second assumption says that the probability of detecting growth in the test system is identical with the probability that the test volume contains one or more particulates, namely:

$$\sum_{x=1}^{\infty} e^{-mv} \frac{(mv)^x}{x!} = 1 - e^{-mv} \quad [3]$$

Thus, in testing  $v$  cc. from a suspension at infection level  $m$  the probability of an erroneously negative test is  $e^{-mv}$ . By varying  $v$  and  $m$  it is possible to explore numerically the probabilities of erroneously accepting suspensions at different infection levels and using different sample sizes. For example, if one tests 500 cc. from a suspension containing 5 particulates per 1,000 cc. the probability of a negative result is 0.08, since

$$e^{-(.005)(500)} = .082$$

Thus, 8 percent of all suspensions at this infection level would pass a test using 500 cc.

The minimum requirements imply that 1,500

cc. of each single strain vaccine will be tested on tissue culture and at least 50 cc. more on monkeys. If assumptions 1 and 2, held for both tissue culture and monkey tests, the additional safety assured by the 50 cc. could for the purposes of this calculation be disregarded. In that case the probability of passing a single-strain pool at infection level 5 per 1,000 cc. would be

$$e^{-(.005)(1000)} \times (\text{probability of a negative in the 1,500 cc. in the trivalent pool})$$

If the infection level for the trivalent pool is also assumed to be .005, this gives a final probability of a false negative of  $e^{-(.005)(2500)}$ .

Thus, the probability of accepting single-strain pools containing 5 virus particulates per 1,000 cc. would be less than 1/100,000 if assumptions 1 and 2 were satisfied. This is the probability given in the White Paper for passing a single-strain vaccine produced at infection level 5 per 1,000 cc. (5a).

### Consistency

There are a number of questions that can be raised about this formulation. We note first that it appraises a lot solely on the basis of the evidence furnished by that lot and makes no use of prior information on the consistency or inconsistency with which negative lots have been produced in the past. In practice the Public Health Service's Technical Committee on Poliomyelitis Vaccine, which must approve each lot before it is released, has "been influenced as much by the plant record for consistency of performance as by the negative results of tests on the individual lots considered" (8). But there has been no precise criterion of what is meant by consistency. This is the question to which we now turn.

We start by borrowing a concept from the literature of quality control and consider the average outgoing quality of lots passing the new safety test. More precisely we ask: What is the probability that a cubic centimeter of a suspension passing the safety test will contain some specified number of particulates, say one or more? Making the same two assumptions as were made earlier we find that no answer to this

question is possible because we do not know the infection level at which any given vaccine is produced. Suppose, for example, that all lots being produced by a manufacturer contain exactly one particulate per liter. Then no matter what the safety test, so long as any lots at all are passed, the outgoing lots will also contain one particulate per liter. In such a case, of course, a considerable proportion of batches submitted would fail the safety test, and it is unlikely that anyone, producer or tester, would feel any great confidence in the safety of the batches that passed. This example suggests that if one wishes to control the probability that an outgoing cubic centimeter contains live virus, one must consider not only the lot being tested but also the past history of testing, that is, the consistency with which safe lots have been produced. It also suggests a general way of proceeding.

Subject to the assumptions made earlier let us initially consider a manufacturer producing a single-strain pool at constant infection level  $m$ . Denote the probability that a cubic centimeter contains one or more particulates infectious for the test system by  $P$ . Then

$$P = 1 - e^{-m} \quad [4]$$

We shall henceforth refer to  $P$  as outgoing quality. Denote the probability that a batch produced at this level of infection will pass when  $v$  cc. are tested by  $Y$ . Then

$$Y = e^{-mv} \quad [5]$$

and

$$P = 1 - Y^{1/v} \quad [6]$$

For this simplest situation we thus have a relation between the probability that an outgoing cubic centimeter contains one or more particulates,  $P$ , and the proportion of lots, which pass,  $Y$ , for constant test level,  $v$ .  $P$  is a quantity that we wish to keep below some minimum level; the amount tested,  $v$ , is subject to our control; and  $Y$ , the proportion of lots passed, can be estimated from past experience. As it stands the model is too simple to be realistic, but solely in the interests of understanding its implications let us explore it numerically. Suppose we set  $P$  at some low level, say  $5/100,000$  and consider  $v=4,500$ , that is, we consider the

entire testing process to consist of a single test of 4,500 cc. of the final trivalent pool. We then have

$$5 \times 10^{-5} = 1 - Y^{1/4500}$$

Solving, we obtain  $Y=80.0$ .

That is to say, if a manufacturer is producing lots at a constant but unknown level of contamination, and if 4,500 cc. of each batch are tested and 80.0 percent pass, then, given the assumptions previously made, it follows that out of every 100,000 cc. released, 5 would be expected to contain one or more live virus particulates.

If now under this model we wish to assure that the probability of live particulates in a cubic centimeter of passed vaccine never exceeds  $5/100,000$ , we pass a lot if, and only if: (a) the lot under consideration passes a safety test involving 4,500 cc.; and (b) at least 80.0 percent of previously tested lots have passed.

In practice we should, of course, wish to safeguard ourselves against a number of contingencies, perhaps the most important of which is that the level of  $m$  fluctuates from time to time. In that case one might wish to use only recent production information in estimating the value of  $Y$  for a producer. Suppose, for example, one looked at only the last 10 lots produced. If the probability of a negative were in fact constant and equal to .8, then the probability of passing all 10 is .11, which is rather high and suggests that a run of 10 negatives is not too improbable even for a  $Y$  less than .8. The probability of passing 20 out of 20 when  $Y=.8$  is, however, .012, while the probability of failing 1 out of 20 is .058. One might thus regard 20 negatives out of 20 as evidence at approximately the .99 level of confidence that  $Y$  was at least equal to .8 and at least 1 positive out of 20 as evidence at this level that  $Y$  might be below .8. An amended procedure for providing that the probability of live particulates in a cubic centimeter from passed lots does not exceed  $5/100,000$  would be to pass a lot if, and only if, it formed part of a run of 20 negative lots. More generally if we denote by  $n$  the size of the run of negative lots required, we have

$$n = \frac{\log a}{v \log (1 - P)}$$

where  $(1-a)$  is the level of confidence.

Size of negative run ( $n$ ) required to insure given confidence  $(1-\alpha)$  that average outgoing infectivity per cubic centimeter is less than  $P$  (for selected values of  $\alpha$ ,  $P$ , and test volume,  $v$ ).

$(1-\alpha)$	$P=1 \times 10^{-3}$	$P=5 \times 10^{-3}$	$P=25 \times 10^{-3}$	$P=50 \times 10^{-3}$
$v=1,000$				
.95.....	303	60	12	6
.99.....	465	92	18	9
.999.....	698	138	28	14
.9999.....	930	185	37	18
.99999.....	1,162	231	46	23
$v=5,000$				
.95.....	61	12	2	1
.99.....	93	18	4	2
.999.....	140	28	6	3
.9999.....	186	37	7	4
.99999.....	233	46	9	5
$v=10,000$				
.95.....	30	6	1	1
.99.....	47	9	2	1
.999.....	70	14	3	1
.9999.....	93	18	4	2
.99999.....	116	23	5	2

We show in the table above the values of  $n$  for various levels of confidence, sample volumes, and levels of outgoing quality.

The rule derived is in a general way consistent with recent practice in accepting and rejecting lots. In the 1954 field trials, however, its use would have led to the rejection of the two lots whose production was preceded and followed by lots which tested positive. The lots which tested positive were discarded, but the two lots sandwiched in between were used in the field trials, a practice inconsistent with any consistency rule. (A rereading of the slides which led to calling these lots positive has, in the light of the accumulated experience, prompted rediagnosis. All four lots are now believed to have tested negative, according to a personal communication from David Bodian. This finding, of course, should not be construed as justification of the 1954 practice but rather

as an explanation of why it did not lead to difficulties.)

Most of the modifications of this model which are required to make it more realistic are straightforward, but involved, and we shall not discuss them. There is one modification of possible interest that we mention here, however. We have justified the rule of estimating  $Y$  only from the 20 previously produced lots by considering the possibility that the level,  $m$ , fluctuates from lot to lot. The relation between  $P$  and  $Y$  was obtained on the assumption that it is constant, however. Does the relation between  $P$  and  $Y$  continue to hold when  $m$  is no longer assumed constant from lot to lot?

A perfectly general answer can be supplied. No matter how  $m$  fluctuates one can show

$$\bar{P} \leq 1 - \bar{Y}^{1/v} \quad [7]$$

where  $\bar{P}$  and  $\bar{Y}$  are averages of equations 4 and 5 over the appropriate distributions of  $m$  (see inset). The equality between  $P$  and  $Y$  pre-

#### Derivation of Equation 7

Define  $P$  and  $Y$  by equations 4 and 5; let  $m$  be the level of infection of a lot, and let  $v$  be the cubic centimeters tested of each lot. If now we suppose that  $m$  has an arbitrary distribution  $F(m)$ , we define  $\bar{Y}$  by

$$\bar{Y} = \int_0^1 e^{-mv} dF(m) \quad [8]$$

and  $\bar{P}$  by

$$\begin{aligned} \bar{P} &= \frac{\int_0^1 (1 - e^{-m}) e^{-mv} dF(m)}{\int_0^1 e^{-mv} dF(m)} \\ &= 1 - \frac{\int_0^1 e^{-m(v+1)} dF(m)}{\bar{Y}} \end{aligned} \quad [9]$$

From Liapounoff's inequality

$$\int_0^1 e^{-m(v+1)} dF(m) \geq \left[ \int_0^1 e^{-mv} dF(m) \right]^{\frac{v+1}{v}} \quad [10]$$

Substituting from equation 10 in equation 9, equation 7 follows. A somewhat more general result has been obtained by Paul Meier in a study as yet unpublished.

question is possible because we do not know the infection level at which any given vaccine is produced. Suppose, for example, that all lots being produced by a manufacturer contain exactly one particulate per liter. Then no matter what the safety test, so long as any lots at all are passed, the outgoing lots will also contain one particulate per liter. In such a case, of course, a considerable proportion of batches submitted would fail the safety test, and it is unlikely that anyone, producer or tester, would feel any great confidence in the safety of the batches that passed. This example suggests that if one wishes to control the probability that an outgoing cubic centimeter contains live virus, one must consider not only the lot being tested but also the past history of testing, that is, the consistency with which safe lots have been produced. It also suggests a general way of proceeding.

Subject to the assumptions made earlier let us initially consider a manufacturer producing a single-strain pool at constant infection level  $m$ . Denote the probability that a cubic centimeter contains one or more particulates infections for the test system by  $P$ . Then

$$P = 1 - e^{-m} \quad [4]$$

We shall henceforth refer to  $P$  as outgoing quality. Denote the probability that a batch produced at this level of infection will pass when  $v$  cc. are tested by  $Y$ . Then

$$Y = e^{-mv} \quad [5]$$

and

$$P = 1 - Y^{1/v} \quad [6]$$

For this simplest situation we thus have a relation between the probability that an outgoing cubic centimeter contains one or more particulates,  $P$ , and the proportion of lots, which pass,  $Y$ , for constant test level,  $v$ .  $P$  is a quantity that we wish to keep below some minimum level; the amount tested,  $v$ , is subject to our control; and  $Y$ , the proportion of lots passed, can be estimated from past experience. As it stands the model is too simple to be realistic, but solely in the interests of understanding its implications let us explore it numerically. Suppose we set  $P$  at some low level, say  $5/100,000$  and consider  $v=1,500$ , that is, we consider the

entire testing process to consist of a single test of 4,500 cc. of the final trivalent pool. We then have

$$5 \times 10^{-5} = 1 - Y^{1/1500}$$

Solving, we obtain  $Y=80.0$ .

That is to say, if a manufacturer is producing lots at a constant but unknown level of contamination, and if 4,500 cc. of each batch are tested and 80.0 percent pass, then, given the assumptions previously made, it follows that out of every 100,000 cc. released, 5 would be expected to contain one or more live virus particulates.

If now under this model we wish to assure that the probability of live particulates in a cubic centimeter of passed vaccine never exceeds  $5/100,000$ , we pass a lot if, and only if: (a) the lot under consideration passes a safety test involving 4,500 cc.; and (b) at least 80.0 percent of previously tested lots have passed.

In practice we should, of course, wish to safeguard ourselves against a number of contingencies, perhaps the most important of which is that the level of  $m$  fluctuates from time to time. In that case one might wish to use only recent production information in estimating the value of  $Y$  for a producer. Suppose, for example, one looked at only the last 10 lots produced. If the probability of a negative were in fact constant and equal to .8, then the probability of passing all 10 is .11, which is rather high and suggests that a run of 10 negatives is not too improbable even for a  $Y$  less than .8. The probability of passing 20 out of 20 when  $Y=.8$  is, however, .012, while the probability of failing 1 out of 20 is .038. One might thus regard 20 negatives out of 20 as evidence at approximately the .99 level of confidence that  $Y$  was at least equal to .8 and at least 1 positive out of 20 as evidence at this level that  $Y$  might be below .8. An amended procedure for providing that the probability of live particulates in a cubic centimeter from passed lots does not exceed  $5/100,000$  would be to pass a lot if, and only if, it formed part of a run of 20 negative lots. More generally if we denote by  $n$  the size of the run of negative lots required, we have

$$n = \frac{\log \alpha}{v \log (1 - P)}$$

where  $(1 - \alpha)$  is the level of confidence.

on the grounds that the increase would be more than counterbalanced by decreases in subsequent years.

It is even more difficult to indicate what factors should be considered in selecting a level of confidence. From a practical point of view, however, the value selected is not as crucial as that of  $P$ . Thus, increasing the level of confidence from .99 to .99999 increases the required length of negative runs by about two- and one-half-fold, whereas decreasing  $P$  from 5 to 1 per 100,000 increases it by fivefold. In general, the choice requires a compromise between the desire for a high degree of confidence and practical limitations on possible sizes of  $n$ .

It is important to realize that, after one has determined a value for outgoing quality, say  $x/100,000$ , and a confidence level,  $1-\alpha$ , it does not necessarily follow that in proportion  $\alpha$  of the negative runs  $x$  cc. in every 100,000 will in fact contain live virus. What will actually happen depends on the safety of the production process. If the production process is safe, such levels will not occur. The logical structure of safety testing, in short, necessitates fixing a maximally tolerable level of outgoing infectivity, but this level need not necessarily ever be realized.

### On the Assumptions Used

The key assumptions of the preceding section are that: (a) a vaccine can be considered as an idealized suspension of randomly and independently dispersed particulates, (b) the tissue culture and monkey tests used can be considered as an idealized test system capable of invariably detecting the presence of a single virus particulate, and (c) a child may be considered maximally sensitive and invariably capable of developing poliomyelitis, even when exposed to a single virus particle.

Several bits of evidence suggest that the last assumption is incorrect by several orders of magnitude. First of all, most persons have developed an immunity to the disease by the time they reach adult age even though not more than 1 percent have ever had clinically manifest poliomyelitis. Associated with this is an increased level of neutralizing antibodies (13), which suggests that most adults were at some

time in life infected by poliomyelitis virus without ever having developed the disease. More direct evidence on this point is provided by a longitudinal study of familial infection with poliomyelitis virus by Fox and associates (14). During a 3-year study of 156 households, they noted the development of 240 cases of infection with poliomyelitis virus as indicated either by the recovery of virus from stools or elevated serum antibody levels or both. There was not a single instance of paralytic disease in any of the 240 cases. Extrapolating these results to the community of which the households were considered to be a sample (for which community the incidence of paralytic poliomyelitis was known) they concluded that 1 paralytic case develops for every 710 cases of infection with poliomyelitis virus by the oral route.

Further suggestive evidence on this point has been brought to our attention by Nathanson and Hall. There were 105 cases of poliomyelitis among family contacts of Cutter vaccinated individuals. These may be presumed to have been infected by vaccinated family members. Only 1 of these 105 family members developed a case of the disease. Thus, on this premise, of 105 individuals sufficiently infected to pass the disease on to others 104 did not develop clinical poliomyelitis. The assumption that a child is maximally sensitive is thus a very conservative one. Testing procedures based upon this assumption will possess a considerable margin of safety, at least on this score.

Turning to the first two assumptions, we note that they imply that if one tests  $v$  cc. of a vaccine at infection level  $m$ , the probability of a positive result is from equation 3,  $1 - e^{-mv}$ .

This relationship between the probability of a positive result and amount tested, often referred to as the one-particle curve, is a well-known relationship in virology. It has been tested on a variety of plant and animal viruses and usually, although not invariably, found to apply (15). In principle, its applicability to the present problem could be tested by varying  $v$  in a vaccine preparation known to contain incompletely inactivated live virus. In practice,  $v$  can be varied only by diluting the vaccine, and the amount of live virus present in the vaccines tested has not been sufficient to give positive responses after dilution. To investigate

viously used now turns out to be an inequality and, fortunately, in the direction to make it useful. Thus, if 80.0 percent of a long series of lots, 4,500 cc. of each of which are tested, test negative, then the probability that a cubic centimeter of passed material contains one or more particulates is equal to or less than  $5/100,000$ . The assumption that  $m$  is constant is consequently the least favorable one for the safety tester, and the procedure suggested is one which protects him against the least favorable a priori distribution of  $m$ .

What are the factors that will influence the level at which  $P$ , the level of outgoing quality, is set? This is not a statistical question and consequently not one to which we can give an answer. It is, nevertheless, a question to which an answer is required, and it is worth indicating briefly some of the issues involved. First of all,  $P$  cannot be set at zero. That is to say, no amount of consistency testing can assure the complete absence of infectivity. The most that can be done is to keep  $P$ , the proportion of infected cubic centimeters, below some preassigned level. In selecting a numerical value for  $P$ , one must be guided by the consequences of the choice. The first major difficulty is that the consequence of introducing one virus particle into a human host is unknown. That is to say, if  $P$  is set at some value say  $5/100,000$ , and the production process is such that five 1-cc. inoculums in every 100,000 released do in fact contain one virus particulate, we are unable to say whether any of the five children receiving the infected inoculums would contract the disease. In the next section we shall consider more closely the relation between exposure to live virus particulates and the subsequent development of disease. Here we shall simply make the overly conservative assumption that all children exposed to one or more live virus particulates invariably develop the disease—that in setting a value of  $P$  we are also setting the incidence rate for poliomyelitis.

Now, the average annual incidence of paralytic poliomyelitis is very low. In the average epidemic year of 1954 it was about 50 per 100,000 persons in the age group 5-9 in areas covered by the field trial of the vaccine (9). The Francis report indicates that the 1954 field

trial vaccines reduced this rate by at least 50 percent, and epidemiological analysis of the 1955 experience leads to much the same conclusion (10). Thus, a value of  $P$  set at, say 50 percent of  $50/100,000$  would not be safe enough since such a safety testing procedure could barely assure that passed vaccines would not cause more cases than they prevented.

The Cutter experience is illuminating. Approximately 400,000 children were inoculated with vaccines from 17 different filling lots produced by Cutter Laboratories. There were 61 cases of paralytic poliomyelitis among these children within 50 days of vaccination and an additional 97 among family or community contacts within 65 days. This amounts to an overall paralytic rate of 40 per 100,000 persons, most of which can be attributed to the vaccine. If we insist on setting  $P$  at 50 percent of  $50/100,000$ , then the level selected is approximately equal to the average Cutter level of infection. Undeniably this is not safe enough and  $P$  must be set well below  $25/100,000$ . How far below  $25/100,000$  is suggested by the fact that Cutter vaccines were withdrawn from use not after 61 cases but after the first 6 cases out of 400,000 vaccinations.

One might of course argue that it is inappropriate to consider the annual incidence of poliomyelitis and that, in fact, a more appropriate magnitude is the lifetime probability of contracting the disease. This probability is a good deal higher, about 800 per 100,000 persons by age 24 according to a study of children of native white parents in 28 cities (11). Since this is 10 to 15 times the annual incidence, one might incline to a value of  $P$  well above  $25/100,000$ . There are several problems raised by this issue, however. First of all, if the risk of infection by the vaccine is to be balanced against the lifetime probability of developing the disease, then it is necessary that the vaccine confer lifetime immunity. Whether this is in fact the case is not now known and presumably will not be known for some time (see Salk (12), however). Second, and perhaps more fundamental, it is doubtful whether any community would (or should) tolerate safety standards that will permit the release of vaccines that raised the incidence of paralytic poliomyelitis in that year

hence on the choice between assumptions 2 and 2'.

In the literature of virology the parameter  $m$  is usually referred to as the number of elementary bodies and the parameter  $pm$  as the number of infectious units. The ratio of infectious units to elementary bodies has been determined for a number of virus-host systems. Two lines of evidence suggest that for the poliomyelitis virus its value in tissue culture may be well below unity and that assumption 2' rather than 2 is the appropriate one. The first is provided by electron microscope photographs of purified poliomyelitis virus preparations. From these it has been estimated that  $p = \frac{1}{30}$  to  $\frac{1}{60}$  (16). The second is provided by the results of intraspinal inoculation with infectious vaccine of monkeys rendered especially sensitive by pretreatment with cortisone. In a number of such experiments the dose required to infect the monkeys has been only a fraction of the dose required for tissue culture. Neither piece of evidence can at present be considered much more than suggestive. The results of the monkey experiments are as yet unpublished and require confirmation, while uncertainty as to the viability of the particles seen in the electron micrograph enjoins caution in interpretation. In the words of Dulbecco and Vogt (17) the relation between infectious units and elementary bodies "is still an open problem of highest interest." The mere fact that it is an open question does suggest, however, that a logical structure which is dependent upon the validity of assumption 2 may not be firmly grounded.

The first assumption, that a vaccine may be considered as an idealized suspension of randomly and independently dispersed particulates has also been questioned. Thus, Veldee has argued (18) that in the original virus suspension a significant proportion of virus particles are known to be imbedded in gelatinous protein material which cannot be removed by the finest filters. He suggests that formaldehyde may harden this material so that the imbedded virus particles cannot attach to the tissue cell in tissue culture. Growth of the virus in tissue culture is thereby prevented. Once the vaccine has been injected into a living animal, he goes on to suggest, enzymes present in the animal, but not in tissue culture, may free the virus particle of

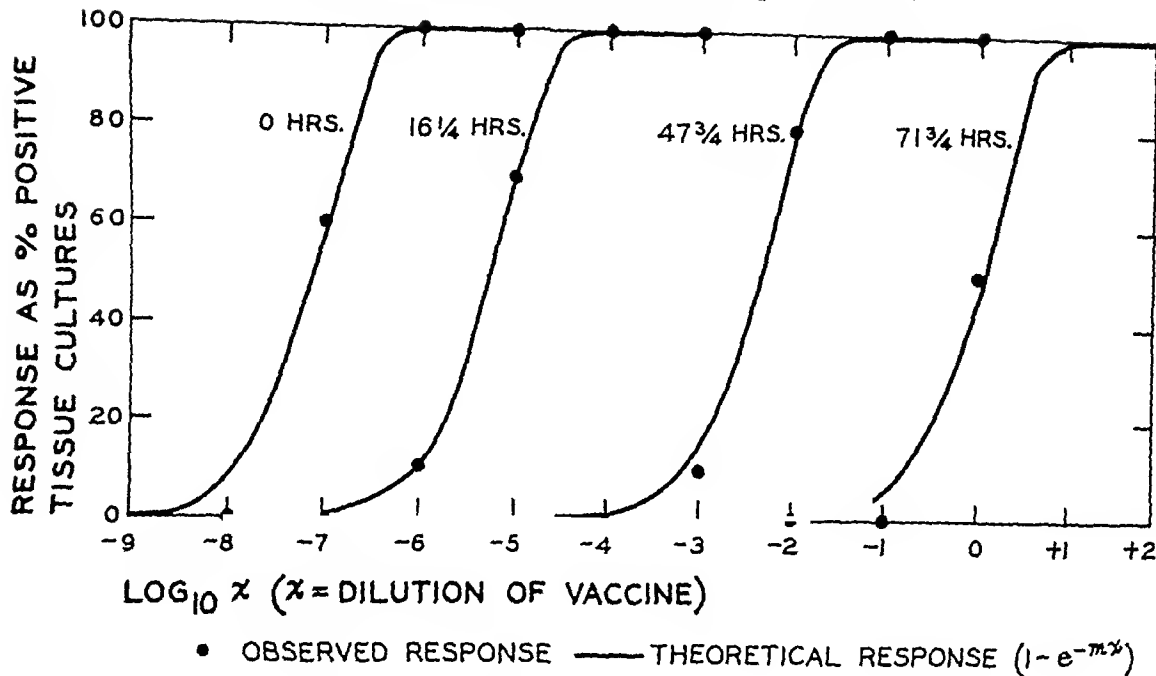
its coating, after which growth may take place. No evidence that would either support or contradict this hypothesis is known to us.

If in the light of this discussion we reexamine the preceding section, it becomes apparent that the three assumptions listed at the beginning of the present section are sufficient but not necessary. The necessary assumptions are less limiting, namely, (a) the test system used is at least as sensitive to the presence of live virus as the human subject and (b) the probability of a negative response in tissue culture is a decreasing exponential function of test volume. The second assumption is supported by results of the type summarized in figure 3. The first is the crucial one and unfortunately the one about which only indirect evidence is ever likely to be available.

To cast some light on its possible validity, we consider the only evidence now available—the results of a cooperative study, undertaken immediately after the Cutter incident, of 16 of the 17 filling lots of vaccine produced by Cutter Laboratories. All 16 lots were tested in tissue culture, the total amount tested being somewhat less than 6 liters, or considerably less than is called for by present minimum requirements. Nine of the sixteen lots were also tested in 391 normal monkeys and 10 of the 16 in 178 intraspinally inoculated monkeys, which had been pretreated with cortisone. Of the 16 lots tested 6 were associated with an excess incidence of poliomyelitis (9). All 6 of these lots gave positive results, and, in addition, 2 of the lots that were not epidemiologically implicated also tested positive, 1 by tissue culture and 1 by cortisone treated monkey. These tests, which are not as extensive as those now called for by the minimum requirements, thus indicate that at least so far as the Cutter lots of the spring of 1955 are concerned the test system now used is as sensitive as and probably more sensitive than the human host. It would, of course, be desirable to have a good deal more information than can be extracted from that experience, but the results as far as they go are in the direction of validating the present testing program. Between the Cutter incident (and after the adoption of the new minimum requirements on May 26) and January 1, 1956, 37,500,000 cc. were released for public use without, so far as is



Figure 3. Tissue culture response during inactivation.



the question, we have consequently turned to data lying behind the inactivation curves previously discussed. The log titers on these curves are obtained by testing four successive tenfold dilutions. A volume of 0.5 cc. of the diluted suspension is introduced into each of 10 tissue culture bottles at each dilution and the presence or absence of viral growth noted. We show in figure 3 the results of one such run at four different inactivation times. The description of the relation between proportion of positive bottles and dose provided by the one-particle curve appears satisfactory, although a more searching examination would be possible if the spacing between dose levels were not so wide. A very large number of such comparisons is in fact possible, one for each single-strain lot of vaccine produced by each manufacturer. We have not investigated more than a fraction of them, but, for most of those that we have, the agreement between observation and hypothesis shown in the figure is by no means unusual.

Such agreement would appear to validate both the assumptions of an ideal suspension and of an ideal test system. This is too hasty a conclusion, however. Aside from the fact that no data are given for inactivation times beyond the third day, the assumption that one par-

ticulate will invariably initiate growth is sufficient but not necessary for the derivation of the one-particle curve. Thus, if we substitute for assumption 2 (p. 1048) the less limiting assumption:

2'. The probability that a virus particulate will initiate growth is constant for all tissue culture bottles and equal to  $p$ , and this probability does not depend on whether other particulates present have or have not initiated growth,

we also obtain the one-particle curve. Thus, the probability that a test batch of  $v$  cc. will contain  $z$  particles and that none of these will result in growth is

$$e^{-mv} \frac{(mv)^z}{z!} (1-p)^z \quad [11]$$

The probability of no growth is simply the sum of such terms over all values of  $z$ , and this sum is simply

$$e^{-pmv} \quad [12]$$

We can estimate the product  $pm$  from data such as that given in figure 3, but not  $p$  and  $m$  separately. In consequence the agreement between observed and theoretical in figure 3 provides no evidence on the numerical value of  $p$  and



# Recent Studies in Surface Disinfection

By R. L. STEDMAN, Sc.D., and E. KRAVITZ, Sc.D.

ALTHOUGH many studies on disinfection have appeared in the literature during the past 75 years, significant and unexpected gaps in our knowledge of germicides remain. Efficiency in disinfecting floors, walls, and ceilings is one of the more significant gaps requiring detailed study. Until 1953, little information on the basic aspects of such disinfecting operations was available although Varley and Reddish (1) and Klarmann and associates (2) presented important but limited data.

For the past few years, the Department of the Navy has been conducting an extensive investigation of the problem at the Industrial Test Laboratory under the cognizance of the Bureau of Ships and Bureau of Medicine and Surgery. Because of the extent of the work, certain portions of this investigation were performed under contract at the Bacteriological Unit, Plant Pest Control Branch, Agricultural Research Service, Department of Agriculture, under the direction of Dr. L. S. Stuart. The salient findings obtained from these investigations to date and the results of certain other pertinent studies recently reported are reviewed in the current report.

When critically examined, disinfection of floors, walls, and ceilings represents a comparatively complex problem because of the many variables encountered in diverse disinfecting

operations. Such variables as the composition of the surface, the degrees of soil and microbial contamination, the type of micro-organisms present, the use of a washing procedure before disinfection, the degree of hardness of the water used in preparing the disinfectant dilutions, and many other factors represent a gamut of test conditions to be examined in a study of this nature.

Initially, it was obvious that not all of these conditions could be thoroughly investigated and that some compromise was required. Ultimately, it was decided to limit the study to floor disinfection by simulated use methods incorporating the various conditions described below.

## Principal Test Methods

Two basic procedures for determining antimicrobial activity were developed for most of the work reported here (3-5). The first, the "Stuart" procedure, was used to measure the effect of precleaning on subsequent disinfection and consists of successively contaminating, cleaning, and disinfecting a large square of surface material. The pattern of elimination of micro-organisms is followed throughout the simulated precleaning and disinfection. The second, the "Square-Diluent" procedure, consists of contaminating and disinfecting 1-inch squares of surface materials in a manner that simulates actual conditions. This technique was used in all studies in which surfaces were not precleaned before disinfection.

The first technique gives a valid picture of the relative changes in antimicrobial numbers since a swab recovery technique is employed. The second method is of more value when the

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known, being related to the development of any further cases. This is consistent with the conclusion suggested by the post-Cutter cooperative tests although it is of course hopelessly confounded with simultaneous improvements in the safety of the production process.

### Summary

The safety of a vaccine will depend both upon the basic safety of the production process and the ability of safety testing procedures to detect an unsafe vaccine, if one is produced. Exclusive reliance upon the safety of a production process with a good past record, without the second line of defense provided by an adequate safety test, may be hazardous. Salk's early discussions of the nature of the inactivation process are reviewed, and his conclusion that safety was assured by the predictable nature of the inactivation process is critically appraised.

The major statistical problem in safety testing involves a decision as to how much testing is required. The procedures used in industrial quality control to solve this problem are not applicable to vaccine testing because the costs of erroneously rejecting good lots and of erroneously accepting bad ones are entirely incommensurable. An answer is derived instead by making certain statistical assumptions as to the dispersion of live virus in the vaccine, the sensitivity of the test system, and the viral concentration which is infective for man. The question of consistency testing is considered and a general theory derived for deciding how many successive lots of vaccine testing negative are required before a producer can be said to be a consistent producer of safe vaccine. Some of the questions that must be answered to apply this theory are considered. The assumptions on which this theory is based are critically analyzed.

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nificance in the concept of disinfection but has been adequately treated elsewhere (6, 7).

### Surface Porosity

Although the above generalization on the relative effectiveness of disinfectant types is valid, surface porosity tends to alter the quantitative pattern in certain instances (table 2). For example, certain phenolic formulations lose much more activity than others in changing from a nonporous to a porous surface (8).

**Table 2. Effect of surface porosity in reducing antimicrobial efficiency of disinfectants**

Germicide	Bactericidal activity <sup>1</sup>			(B) (A)	(C) (A)
	Stainless steel (A)	Asphalt tile (B)	Battleship linoleum (C)		
Phenolic A.....	1:50	1:25	1:10	0.50	0.20
Phenolic B.....	1:100	1:5	1:5	0.050	0.050
Phenolic C.....	1:125	1:25	-----	0.20	-----
Phenolic D <sub>1</sub> .....	1:100	1:25	-----	0.25	-----
Phenolic D <sub>2</sub> .....	1:200	1:50	-----	0.25	-----
Cresylic.....	1:100	1:100	1:10	1.0	0.10
Coal tar.....	1:120	1:10	-----	0.033	-----

<sup>1</sup> Dilutions of formulation required to reduce *Micrococcus pyogenes* var. *aureus* to 99.99 percent of original number in the presence of serum.

SOURCE: Reference 8.

The extent of this loss is apparently determined by the nature of the porous surface since significant differences in activity are observed on materials such as asphalt tile, battleship linoleum, soapstone, and wood. In most instances, chemical interaction between surface and germicidal agent is not observed and it seems valid to infer that porosity per se accounts in a large measure for these differences.

Superficial observation of the effective dilutions of germicides required for disinfection of the various porous surfaces (table 2) shows that impractically high concentrations are needed in many instances. Also, a different use-dilution of the same disinfectant may be

required for each porous surface. Obviously, it is not practical to employ such a multiplicity of use-dilutions with a disinfectant product. Some alternative procedure must be used to combine antimicrobial effectiveness and simplicity of operation.

Studies on this point have revealed that the effectiveness of the use-dilution recommended for a nonporous surface can be enhanced on a porous surface by the use of long exposure times and by successive treatments of the surface with germicide (9, 10).

As might be expected, the reduction of microbial numbers increases with length of exposure time and continues even after drying of the disinfectant is visibly completed. However, the time relationship is not linear, and after the first 10 minutes of exposure, the survivor curves tend to become asymptotic. For all practical purposes, the effective reduction in numbers is reached after the first 30 minutes.

Two successive applications of disinfectant are more effective than a single prolonged application in most instances, although the same pattern of initial rapid action followed by an asymptotic rate of reduction is encountered. With some disinfectants it appears that many successive applications on porous surfaces are required to achieve the same degree of effectiveness as attained on a nonporous surface such as stainless steel. At any rate, a significant increase in efficacy can be obtained by the use of long exposure times and successive germicidal applications, thus permitting a single use-dilution of disinfectant to be employed on a wide variety of surfaces.

### Cumulative Effect

A daily routine program of applying disinfectants to floors produces an enhanced sanitary effect. Apparently, each successive daily application provides a prolonged residual of disinfectant which contributes to the antimicrobial efficiency of the next application (9). The degree of contribution is undoubtedly a function of the rate of evaporation, that is, vapor pressure, of the particular product since formulations vary rather widely in this respect. Ambient relative humidity is also of significance

absolute numbers of microbial survivors are required. Both techniques are versatile and permit the inclusion of many significant variables in actual disinfecting procedures.

### Disinfectant Specificity

Obviously, the most useful disinfectants possess a minimum of antimicrobial specificity. In practical terms, this means that a disinfectant should be effective against a wide spectrum of microbial species when employed at a practical use-dilution. The particular specificities of some types of germicides have been known for some time, for example, the failure of unfortified pine oil formulations to be effective against pyogenic cocci. However, deficiencies in other types became apparent during the study. Table 1 presents representative data to illustrate this point.

On surfaces not precleaned, the quaternary ammonium germicides are effective under certain conditions. Substantial increases in the manufacturers' recommended concentrations of quaternaries are needed to achieve a high degree of bactericidal activity, but the new use-dilutions are not impractical to employ (table 1). However, these germicides are seriously deficient in antifungal activity, and require impractically strong concentrations in most instances.

The particular chlorine product tested was

much less effective against pyogenic cocci than against enteric bacilli and dermatophytic fungi (table 1). However, it cannot be stated at this time that chlorine products in general show this extreme specificity under conditions simulating floor disinfection because of the limited number of chlorine products tested. Also, it should be emphasized that such specificity may not be evident when the above or any chlorine product is employed as a sanitizer or water decontaminant; the environmental conditions in these instances, bacterial load, exposure time, physicochemical factors, and the like, are entirely different from those encountered in floor disinfection.

The synthetic phenolic and unfortified cresylic acids and coal tar products show less specificity than the other products. In most instances, the manufacturer's recommended use-dilutions are effective against the three test organisms. This is, perhaps, understandable, since the classical determination of use-dilution by extrapolation of laboratory data, that is, use-dilution in practice =  $20 \times$  phenol coefficient obtained in a standard laboratory procedure, has been found to be more applicable to synthetic phenolics and related types than to quaternary ammonium germicides and halogens (6). However, discrepancies can readily be demonstrated even with the phenolics (7). This entire question of the correlation between phenol coefficient and recommended use-dilution is of sig-

Table 1. Disinfection of a nonporous surface (stainless steel) by various germicides without precleaning

Germicide	Recommended use-dilution	Effective dilutions <sup>1</sup>					
		Without serum			With serum		
		MPA	SS	TI	MPA	SS	TI
Phenolic A.....	1:250	1:250	1:1500	1:250	1:130	1:250	1:130
Cresylic.....	1:150	1:150	1:600	1:180	1:150	1:600	1:150
Chlorine.....	<sup>2</sup> 1:5000	1:310	1:3100	1:4600	<1:310	1:3100	1:4000
Quaternary ammonium.....	1:2500	1:1000	1:1000	<1:100	1:1000	1:1000	<1:100

<sup>1</sup> Dilutions of formulations (active ingredients only) required to obtain 99.99 percent reduction (bacteria) or 99.9 percent reduction (fungus) in Square-Diluent method. See reference 4 for details.

<sup>2</sup> Based on available chlorine.

MPA = *Micrococcus pyogenes* var. *aureus*; SS = *Salmonella schottmuelleri*; TI = *Trichophyton interdigitale*.

stances, the handling of infectious matter without disinfectant protection during manipulation of swabs and buckets while precleaning may be a potentially hazardous operation. Also, the additional work of precleaning detracts from the simplicity of the operation. The presence of cleaner residues may deleteriously affect subsequent disinfection if an intermediate rinsing step is not employed. The inclusion of such a step adds still more complexity to the operation. Other disadvantages can be detailed. Nevertheless, it seemed of significance to study a number of phases involving precleaning.

The efficiency of mechanical removal of micro-organisms from surfaces by cleaners has been shown to be a function of the porosity of the test surface. Flannery and associates (3) observed that, using standard Navy soap powder, dried white oak was more difficult to decontaminate than soapstone; stainless steel was most easily decontaminated of the three surfaces studied. No significant difference was found when four different types of cleaners, white floating soap, a non-ionic detergent, trisodium phosphate, and Navy soap powder, were tested under comparable conditions on a white oak surface.

Surprisingly large numbers of organisms

were shown to resist removal by mechanical cleaning. For example, after six successive washings of an artificially contaminated porous oak surface, approximately 2-6 percent of the original number of organisms still remained on the wood. Assuming an initial arbitrary load of 2,000,000 organisms per square inch, a relatively large number, 40,000-120,000, would still be present after precleaning in such cases. Although decontamination of stainless steel was more easily accomplished (99.90-99.98 percent of original cell numbers removed by two washings), small numbers of organisms could still be recovered from the nonporous surface even after six consecutive washings. The concentration of the cleaner affected the efficiency of removal in some instances, but the differences were not striking.

Evidently, mechanical removal of micro-organisms by precleaning does not obviate the need for a very efficient disinfectant. Further data on this point are shown in table 4. An artificially contaminated soapstone surface was precleaned (one wash) with trisodium phosphate and then disinfected with various levels of sodium hypochlorite or the quaternary ammonium germicide, alkyl ( $C_{17}H_{37}$ - $C_{18}H_{37}$ ) dimethyl benzyl ammonium chloride (3). In no case was complete elimination of all test or-

**Table 4. Efficiency of halogen and quaternary ammonium disinfectants in decontaminating soapstone after one precleaning step with 0.2 percent trisodium phosphate<sup>1</sup>**

Dilution of disinfectant used	Sodium hypochlorite				Alkyl ( $C_{17}H_{37}$ - $C_{18}H_{37}$ ) dimethyl benzyl ammonium chloride			
	Percentage reduction (all organisms)	Percentage positive swabs			Percentage reduction (all organisms)	Percentage positive swabs in qualitative tests		
		SS	SF	TI		SS	SF	TI
1:10,000	91.7	100	100	100	94.5	100	100	100
1:5,000	99.6	100	100	25	97.8	100	100	100
1:2,500	99.5	50	100	25	97.7	100	100	100
1:1,670	99.88	50	100	25	97.3	100	100	100
1:1,250	99.88	0	100	25	97.8	100	100	100
1:1,000	99.84	0	100	25	99.1	50	100	100

<sup>1</sup> 12- x 24- x 2-inch block of soapstone contaminated with mixture of three test organisms and soil. Surface washed once with 0.2 percent trisodium phosphate, the cleaner drained off, and the area disinfected with indicated disinfectants. Standard (4" x 4") areas then swabbed, the swabs rinsed in water and then incubated in appropriate differential media. "Percentage reduction" refers to number of organisms recovered in swab rinse water. "Percentage positive swabs" refers to total number swabs which were positive after incubation. SS=*Salmonella schottmulleri*, SF=*Streptococcus faecalis*, TI=*Trichophyton interdigitale*.

Source: Reference 3.

**Table 3. Physicochemical properties of formulations displaying various degrees of retention of bactericidal activity on changing from a nonporous to a porous surface**

Germicide	Comparative order of efficiency <sup>1</sup>			
	Surface tension depression <sup>2</sup>	Spreading wetting <sup>2</sup>	Detergency <sup>2</sup>	Retention of bactericidal activity <sup>3</sup>
Cresylic.....	2	1	2	1
Coal tar.....	6	6	6	6
Phenolic A.....	4	5	3	2
Phenolic B.....	7	7	7	7
Phenolic C.....	5	4	1	5
Phenolic D <sub>1</sub> .....	1	2-3	4-5	3-4
Phenolic D <sub>2</sub> .....	3	2-3	4-5	3-4

<sup>1</sup> Relative effectiveness of the seven germicides for each of the indicated properties. 1=most effective; 7=least effective.

<sup>2</sup> See reference 12 for techniques and details.

<sup>3</sup> Based on ratio of bactericidal activities on porous and nonporous surfaces. See table 2.

<sup>4</sup> These products gave identical results in the indicated tests.

in this regard (11, 12). With many disinfectants the residual is sufficient to kill small numbers of organisms without the aid of additional disinfectant after contamination (2, 9, 11). Such an effect may be of importance in the elimination of dustborne hemolytic streptococci and other organisms in hospital wards, dispensaries, and the like.

### Formulation Properties

As noted above, disinfectant formulations, even of the same chemical type, vary widely in the degree of antimicrobial activity retained on a nonporous as compared to a porous surface.

These variations in retention of activity have been shown to be due, at least in part, to differences in certain physicochemical properties of formulations (13): surface tension depression, spreading wetting and detergency. Although a quantitative correlation between retention of activity and any of these properties could not be demonstrated, some relationship was noted (table 3).

Products with poor or excellent retention were found to possess relatively poor or excellent efficiencies in the physicochemical proper-

ties. This relationship is, perhaps, not unexpected since surface tension depression, wetting, detergency, suspending power, emulsification, and other similar properties contribute in various degrees to the penetration and cleansing of porous surfaces. Superior penetration and disinfection of the crevices and pores of surfaces such as battleship linoleum or asphalt tile would be anticipated with a product outstanding in the above physicochemical properties. Undoubtedly, the failure to establish a concise correlation shows a complex interrelation of the many physicochemical properties which contribute to disinfection.

Ortenzio and associates (13) have also emphasized the importance of the physicochemical properties of formulations in disinfection. A graphic demonstration of the enhancement of disinfectant efficiency was shown by the addition of small amounts of cleaners and sequestering agents to various types of disinfectant use-dilutions. The enhancement was believed to have resulted from an improvement in the soil suspending and dispersing properties of the solution. The authors concluded that consideration should be given to requiring certain standards for soil suspending and dispersing properties of disinfectants when a combined cleaning and disinfecting action is claimed on the label.

Unfortunately, many commonly employed laboratory methods for determining disinfectant activity present an array of physicochemical factors which bear little or no relationship to those encountered when the disinfectant is used in practice, although a tendency has been noted more recently to employ simulated use procedures. Further effort should be devoted to a study of such procedures and to the development of formulations having physicochemical properties which enhance antimicrobial effectiveness in use.

### Precleaning

On superficial examination, it might be expected that precleaning of a contaminated surface prior to disinfection would produce a much more effective process than disinfection without precleaning. However, there are certain obvious objections to such a process. In some in-

posited on wax-coated surfaces in simulated-sneezing experiments (15). Probably, moisture is required for a lethal action to occur, as in the case of all known antimicrobial agents, and ambient relative humidity may play a significant role.

The degree of effectiveness may be equivalent at best to that of disinfectant residues remaining on surfaces as a result of a routine daily treatment, but significant elimination of gross contamination deposited on surfaces coated with germicidal waxes without further addition of a disinfectant seems distinctly improbable. The exact role of these agents in environmental sanitation must await further study.

### Summary and Conclusions

The salient points obtained in an extensive investigation of floor disinfection conducted by the Department of the Navy have been presented. The implications of other current findings in the literature have also been integrated and presented.

Using test procedures that attempt to simulate use conditions, investigators determined that the degree of efficiency of disinfectants used on floors is influenced markedly by the porosity of the floor surface. Certain representative chemical types of disinfectants were shown to be deficient in antimicrobial activity particularly in regard to species specificity. With synthetic phenolic formulations, the efficiency of disinfection of porous surfaces is related significantly to the physicochemical properties of the formulation. However, by long exposure times or by successive treatments with germicide, a significant reduction in microbial numbers on a porous surface can be achieved. Waxing of porous surfaces apparently does not alter strikingly the efficiency of disinfection attained on the unwaxed surface. A daily routine of disinfection contributes significantly to the ease with which porous surfaces can be decontaminated.

Studies on the effect of precleaning surfaces before disinfection have shown that the efficiency of the cleaning operation is also intimately related to surface porosity. Unfortunately, the contribution of precleaning to the

disinfecting process is greatest on nonporous surfaces which are, in themselves, relatively easy to decontaminate by a single application of germicide. The types of cleaner and disinfectant employed must be carefully chosen since residuals of cleaner remaining may seriously inactivate the germicide if the two are incompatible.

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ganisms achieved with one application of either germicide up to concentrations of 1,000 p.p.m. after precleaning. Antimicrobial effects were initially observed at 200 p.p.m. halogen and 1,000 p.p.m. quaternary.

It was concluded: "The concentrations of germicides necessary to produce disinfection of soiled surfaces after cleaning by a swab-washing procedure (with the exception of highly polished surfaces such as stainless steel) appear to be from three to five times as great as those commonly accepted for use as final germicidal rinses for dishes and glasses in restaurants, and utensils and equipment in dairies and food plants."

The latter portion of this quotation is of significance in that hypochlorites and quaternaries are used primarily as sanitizing agents, and it was desired to relate in some fashion recommended sanitizing use-dilutions with effective disinfecting operations.

In general, the data in tables 2 and 4 (3, 8-10) indicate that the porosity of the test surface is of prime importance in deciding the effectiveness of a precleaning operation in reducing the load on the disinfectant subsequently employed. Porous surfaces can be more easily decontaminated when precleaned, but relatively strong concentrations of germicide are still required in the subsequent disinfecting operation. Unfortunately, precleaning appears to be most effective under conditions in which disinfection alone can be readily accomplished, that is, on a nonporous surface. It is questionable whether precleaning is worth the effort under such conditions, assuming that an effective disinfectant at proper concentration is ultimately employed.

### Effect of Cleaner Residues

As noted above, residues from precleaning procedures may affect deleteriously subsequent disinfection if such residues are not thoroughly removed by rinsing. Ortenzio and co-workers (14) have demonstrated the extent of this inactivation using quaternary ammonium and phenolic disinfectants.

As expected, the chemical nature of the cleaner determines the extent of inactivation. Soaps are more deleterious to quaternaries than phenolics, and the reverse is true for non-ionic

detergent cleaners. When the cleaner and disinfectant are "incompatible," as much as 2.5 times more disinfectant is needed to produce the same antimicrobial effect as in the case of a "compatible" combination. Even alkaline inorganic cleaners, such as trisodium phosphate and sodium carbonate, may seriously inactivate quaternary ammonium disinfectants if soil containing fat is present, presumably due to formation of traces of soap.

It is apparent that an effective precleaning procedure, if employed, must be discriminately chosen and be properly performed.

### Waxing

Since the practice of waxing surfaces is widespread in civilian and military establishments where pathogenic micro-organisms may be of significance, the effect of such a practice on subsequent disinfection has been determined (9). Surprisingly, the antimicrobial effectiveness of disinfectants on a waxed linoleum surface was not found to be strikingly different from an unwaxed surface. This was attributed to the failure of the wax to form a microscopically smooth outer layer and, in effect, transform the porous linoleum surface into a nonporous one. The waxed surface was significantly scratched and pitted after the waxing operation, presumably, because of the action of the buffing machine and solvent evaporation. For all practical purposes, the waxed surface was still porous.

Quite recently, "germicidal" floor waxes have been placed on the market. Such products consist of self-polishing water emulsion waxes with germicidal agents added (15). Present formulations list either a quaternary ammonium or a phenolic disinfectant as the biologically active ingredient. Possibly, these products act physically in a manner similar to "insecticidal" waxes which have been in use for a number of years: The biologically active material slowly leaches to the surface of the wax and provides an insecticidal or germicidal outer layer.

Since only preliminary data are available on the efficacy of germicidal floor waxes, a definitive conclusion on their usefulness cannot be made at present. However, it has been shown that these formulations are capable of eliminating small numbers of organisms which are de-



# A Scientific Approach to Fetal Wastage In Halifax County, North Carolina

By ROBERT F. YOUNG, M.D., M.P.H.

**H**ALIFAX COUNTY, a rural county in eastern North Carolina, had reason to search for the causes of its high infant mortality rates. The 1952 rate had soared to an all-time high of 72.9 per 1,000 live births. Neonatal and premature death rates had climbed to 42.7 and 21.4 in 1952. Prematurity was the second leading cause of death that same year, outranking cancer and accidents.

Halifax County's population of 60,000 is 58 percent Negro. The birth rate for Negroes in 1952 was 35.2 as compared with 21.5 for white residents. Only 36.2 percent of all deliveries, white and nonwhite, occurred in hospitals. The county has 25 private physicians and 2 hospitals. There are 2 hospitals in the adjacent counties also.

Midwives were called in to attend 79.9 percent of all Negro home deliveries. Patients for midwife delivery are required to be certified either by a physician in private practice or by a clinician in charge of one of the 4 prenatal clinics operated by the county health department. The midwives are licensed by and work under the direct supervision of the health department.

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Representatives of the North Carolina State Board of Health, University of North Carolina School of Public Health, North Carolina Medical Society, Halifax County Medical Society, and the Children's Bureau of the Department of Health, Education, and Welfare joined forces with the Halifax County Health Department in seeking answers to that vexing question, "Why does immature as well as defective fruit fall from the tree of life?"

An ambitious and well-designed research project on infant mortality tailored for Halifax County and neighboring counties with high rates failed to obtain supporting funds. The county health department and the allied groups persisted in exploring ways of using available facilities and local personnel in a demonstration program that might favorably influence infant mortality and morbidity rates. During these studies and conferences, three factors seemed to occur again and again:

- The plans for demonstration programs were lacking in adequate analysis and application of pertinent data.
- The diets of prenatal clinic patients were markedly deficient in protein and in other nutrients.
- Certain of these women habitually produced fetal deaths, premature infants, or babies who failed to survive the neonatal period.

## Pinpointing the Problem

With the help of statistics and health education consultants, our public health nurses and secretaries undertook to remedy the deficiency in statistical data by preparing accurate tabula-

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## Shellfish Sanitation Workshop

A Shellfish Sanitation Workshop, held in Washington August 27 and 28, 1956, had a registered attendance of 58. Fourteen States were represented by 18 persons. The oyster industry was represented by 6 persons designated by the Oyster Institute of North America and by 2 representatives from the National Fisheries Institute. The Canadian Government had two representatives (Department of National Health and Welfare, and Department of Fisheries). Other agencies or organizations with representatives present included the Public Health Service, Departments of Army, Navy, and Air Force, Food and Drug Administration, Fish and Wildlife Service, American Cyanamid Co., and the University of Maryland. The Association of State and Territorial Health Officers was represented by Dr. Mack I. Shanholtz of Virginia.

The manual of recommended practice for sanitary control of the shellfish industry, as revised at the meeting, was unanimously adopted by the workshop for use as a guide in the cooperative shellfish certification program.

On the basis of studies made by the Canadian Department of National Health and Welfare, the Maryland Department of Health, the Virginia Department of Health, and the Public Health Service Shellfish Sanitation Laboratory, a 1-year interim

bacteriological market standard was adopted for shucked oysters. This interim standard is the first of its kind in the 31-year history of the shellfish program and establishes three categories of evaluation:

Category	Coliform MPN	Standard plate count
Acceptable.....	Not more than 16,000 per 100 ml.	Not more than 50,000 per ml.
Acceptable on condition. <sup>1</sup>	Less than 160,000 per 100 ml.	Less than 1,000,000 per ml.
Rejectable.....	160,000 or more per 100 ml.	1,000,000 or more per ml.

<sup>1</sup> Shipments will be reported to the shellfish control organization of the originating State for investigation and will not be rejected unless the report of the investigating authority is unsatisfactory.

The workshop also considered effects of the dis-Public Health Service to undertake an investigation of organisms other than coliforms as indicators of the sanitary quality of shellfish.

The workshop also considered effects of the disposal of wastes from cabin cruisers and other shipping. Harold F. Udell, New York State Department of Conservation, estimated there were approximately 15 to 16 thousand pleasure craft equipped with toilet facilities and registered in the Marine District of the State of New York.

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- The plans for demonstration programs were lacking in adequate analysis and application of pertinent data.
- The diets of prenatal clinic patients were markedly deficient in protein and in other nutrients.
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## Pinpointing the Problem

With the help of statistics and health education consultants, our public health nurses and secretaries undertook to remedy the deficiency in statistical data by preparing accurate tabula-

tions of infant, neonatal, fetal, premature, and maternal deaths, by race, for the 5-year period 1947-51. These statistics, though available in the health department, had not been assembled for maximum effectiveness.

Next, they collected and assembled pertinent details on exact geographic location of the patient's home, cause of the infant or maternal death, type of attendant (whether physician or midwife), and the place of delivery (whether in the hospital or at home). They also compiled complete details about the weight, period of gestation, attendant, place, and date of delivery of premature births. Because an epidemic of infectious diarrhea in one section of the county in 1952 had contributed to the high infant death rate, they made a special study of infant deaths from infectious diarrhea, analyzing the records in a local hospital that had been particularly affected.

After all information had been checked for accuracy with the vital statistics section of the State health department, the consultants were called in to recommend the best way of presenting the material to the health department staff, professional groups in the county, and key civic and voluntary organizations. They agreed that our presentation should be a combination of tables, graphs, and large county maps on which premature births and other associated infant mortality data would be plotted by the public health nurses.

Flip charts were prepared from semitransparent tracing paper. Separate sheets of each 48"×34" chart were superimposed over a basic map of Halifax County, showing the general outline of townships and local divisions.

It was apparent from the presentation material that most of the infant deaths had occurred in three distinct areas of the county. This epidemiological observation led us to set up a prenatal demonstration clinic in each area.

**Concentrating on Diet**

Attention was next directed to the nutrition of prenatal patients. Careful review of their clinic records over a 3-year period revealed that the great majority of these patients drank no milk or at best an insufficient amount. Other protein foods in their diets during pregnancy were also inadequate.

Public health studies have documented the fact that low protein diets among prenatal patients are partly responsible for high maternal, infant, and related mortality and morbidity rates. These observations were emphasized at the 1955 meeting of the American Public Health Association, when Dr. August R. Lindt, the permanent observer of Switzerland to the United Nations, reviewed the benefits of surplus milk for prenatal patients and children in 45 different countries before the National Citizens Committee of the World Health Organization.

To aid study of the nutrition factor in local infant mortality, consultants in obstetrics and nutrition helped us design a special record for appraising the characteristics of the diet of prenatal patients. Because of the large number of new cases admitted to the demonstration clinics and the limited number of personnel, the record had to be simple in form yet adequate for the desired information.

For evaluation of each patient's diet, public health nurses record the food consumed at the three meals preceding the clinic visit as well as the food eaten between meals and at bedtime. This information is entered under separate sections for "breakfast" and "between," "lunch" and "between," "supper" and "bedtime" in a column of the diet record headed "food and amounts." The food items are coded in a second column and scored in a third.

The diet is rated "good" (9-10 points), "fair" (7-9 points), and "poor" (below 7 points) according to the following guide.

Code	Food and amount	Possible score
F & V----	Fruit and vegetables----- ½ cup fruits, vegetables, or juice=1 point	4
M-----	Milk----- 1 cup=1 point 2 cups=2 points 3-4 cups=3 points	3
P-----	Protein food----- 2 servings of 3 oz. lean meat or equivalent	2
B-----	Bread and cereals----- 2 servings	1
	Perfect score-----	10

As soon as these records were completed, the nutrition consultants began holding inservice training sessions for nurses, 2 hours each week

over a period of 6 weeks. Training in nutrition included a careful study of the diet records and diet histories of the demonstration patients; instruction in nutrients, food portions, and food values; and methods of teaching food values to clinic patients.

Knowing that surplus nonfat dry milk was available to public schools and other public institutions in the county, we explored the possibility of obtaining this important protein food for the prenatal patients whose diets were deficient in protein. The surplus commodity food section of the State department of agriculture approved our proposal for issuing free milk to medically indigent patients in the demonstration clinics, and the county welfare department certified their eligibility.

A patient who receives an allotment of 9 pounds of dry milk every 30 days during her pregnancy is provided with the equivalent of 1 quart of fluid milk a day. Clinic classes and individual conferences are held to show prenatal patients how to use dry milk for drinking and cooking. They learn, too, about other protein foods that are locally available.

An inventory showing the amount of milk received and distributed each month is kept for the department of agriculture. Other records include a form on which patients acknowledge receipt of the milk and agree to its use as prescribed by the clinic and a form on which public health nurses determine medical indigency.

During the first 6 months of the demonstration program, a public health nurse visited the patients participating in the milk distribution to assure that dry milk was being used in accordance with the clinic's instructions. (Home visits for this purpose have since become a part of the generalized public health nursing program.) Throughout the country, home economics teachers, home demonstration agents, and 4-H club leaders were alerted to the objectives of the surplus milk program so that they also could emphasize the importance of protein foods in prenatal diets.

### Finding the Problem Patients

The third factor in our initial studies had repeated itself with stubborn regularity: Certain women attending the clinics seemed to produce

more than their share of infant deaths and related morbidity and mortality. To find the problem cases on which to concentrate preventive efforts, we designed a screening device that combined a maternity record and a score sheet on which to grade the pregnancy risk of the mother and the survival risk of the fetus.

### *Maternity Record*

The maternity record is still undergoing trial in the prenatal clinics. It is designed so that grades of "good," "fair," or "poor" risk are given in each of seven major sections: (a) mother's previous obstetrical history, (b) her previous medical history, (c) the family history, (d) the mother's diet, (e) physical examination (including pelvic evaluation), (f) laboratory and X-ray findings, and (g) subsequent antepartum visits. The total risk for each patient is based on the grades in each of these respective sections.

At the close of each clinic session, nurses review and grade each patient on the major sections of the record. Patients graded "fair" or "poor" are selected for more frequent visits to the prenatal clinics and for intensive followup through home visits by the nurses.

The following outlines from two sections of the trial maternity record illustrate the grading system.

*Previous Obstetrical History.* A grade of "good" is given to the patient whose previous obstetrical history is essentially negative. A grade of "fair" is based on any one or a combination of the following factors:

1. Seven or more deliveries.
2. One abortion.
3. A history of any single complication other than toxemia; for example, hemorrhage (antepartum) or mild hypertension.
4. One premature child living or dead, 1 fetal death, or 1 infant death.

A grade of "poor" is based on any one or a combination of the following criteria:

1. Cesarean section.
2. Two or more abortions.
3. History of toxemia.
4. History of 2 or more other complications.
5. Two or more premature children living or dead, 2 or more fetal deaths, or 2 or more infant deaths.

6. A combination of 2 or more abortions, premature births, fetal deaths, or infant deaths.

*Physical Examination.* A grade of "good" is given to the patient in good general condition with essentially negative findings on her physical examination. A grade of "fair" is given when the physical examination reveals the following conditions:

1. More than 20 percent overweight.
2. Blood pressure 140/90 or above.
3. Edema of the feet.
4. Inactive tuberculosiis.

5. Any other condition or combination of conditions that, in the examining physician's judgment, would grade the patient's physical condition as fair.

A grade of "poor" is justified when these conditions are present:

1. A combination of elevated blood pressure, increased weight, and edema.
2. Hypertension 150/100 or above.
3. Active pulmonary tuberculosis or syphilis.
4. Edema of the feet and hands, or edema of the face, or both.
5. Organic heart disease.
6. Marked deformity of the spine.
7. Breech presentation.
8. Serious change in the fetal heart rate such as inability to hear the fetal heart sounds.

9. Contracted pelvis or any other serious deficiency in the pelvic measurements.

10. Any other condition or combination of conditions that, in the examining physician's judgment, would grade the patient's physical condition as poor.

### *Grade of Risk*

The final calculation of the grade of risk for each patient is based on these criteria for "good," "fair," and "poor." It must be emphasized that the grading is influenced by local conditions.

*Good.* A patient whose maternity record is essentially negative in all seven sections is graded a good risk.

*Fair.* Grades of "fair" for the sections on previous obstetrical history and physical examination or the section on laboratory and X-ray findings would automatically grade the patient as a fair risk. A grade of "fair" in two or more of the remaining sections, namely, pre-

vions medical history, family history, and diet, would give the patient a grade of risk of "fair."

*Poor.* A grade of "poor" for the section on previous obstetrical history and the section on physical examination or the section on laboratory and X-ray findings would automatically give the patient a grade of risk of "poor." A rating of "poor" in two or more of the other sections would give the patient a grade of "poor."

A sudden increase in weight or blood pressure, the appearance of significant edema, bleeding, any other significant findings, or a combination of conditions might warrant, of course, a change in the grade of risk under the section on antepartum visits.

Although from a first glance the grading system might appear cumbersome and complicated, I hasten to add that, after a relatively short period of working with the record, nurses and clinicians are able to evaluate the patients with speed and accuracy. The record serves not only to select patients of special risk but also to emphasize to our clinic personnel those factors which are of major significance in the prognosis of the prenatal patient.

### *Evidence of Decline*

My purpose has been to review a purely local approach to a specific local public health program. I have attempted to suggest that even when outside help is not available on a grand scale and the local resources and facilities are limited there is still a great deal that can be accomplished by applying the fundamental tools of public health.

Although there has been a decline in pertinent rates, we feel that the program should be continued for a longer period of time before attempting an analysis of these data.

Lest I may have given the impression that Halifax County's approach to the problem of fetal wastage is a final solution, I wish to emphasize that our experience underlines the need for more intensive investigation of the unknown factors.

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*Samples of the forms described are available from the Halifax County Health Department.*

# Legislation on Air Pollution

By FREDERICK S. MALLETTE

THERE IS considerable evidence to show that today the forms and degrees of air pollution are demonstrably worse than ever in human history. The causes of this increase in pollution are, briefly: the tremendous growth of population in our cities, owing to both migration and birth rate; the enormous increase in numbers of automobiles, trucks, and buses and their associated exhaust gases; the incineration of vast volumes of rubbish; the combustion, both domestic and industrial, of megatons of fuels; and the great expansion of manufacturing processes of all kinds, resulting in new and, as yet, uncontrolled effluents.

The atmospheric sewer is backing up and, like a swarming bacterial colony, we are beginning to suffer from the accumulation of our own wastes.

To control the atmospheric byproducts of modern civilization, we have turned to a good old-fashioned remedy, the law. We are trying, at the moment, to legislate air pollution out

of existence. The solution to the problem is not quite so simple.

## Modern Legislation

Most early laws and ordinances dealt with smoke only; fly ash or soot appeared in the picture somewhat later. In this country, the earliest recognized instance occurred not quite 100 years ago, when an 1864 lawsuit in St. Louis resulted in a judgment declaring smoke to be a nuisance. This action was followed 3 years later by adoption of an ordinance requiring that the chimneys of all manufacturing establishments be at least 20 feet above the adjoining buildings.

Chicago adopted its first smoke ordinance in 1881. This provided that the emission of dense smoke "shall be a public nuisance." No definition of smoke or of its density was given.

A 1912 survey by the United States Bureau of Mines found that 12 cities with a population of less than 50,000 had either a smoke ordinance or a smoke inspector and that about 19 cities of 50,000-200,000 were active in the suppression of smoke. Of the 28 cities with more than 200,000 population, 23 showed activity.

Contra Costa County, Calif., in 1915, adopted an ordinance restricting "fume" strength as an outgrowth of the Selby smelter problem. However, the first countywide legislation and enforcement appeared in Hudson County, N. J., in 1931.

The first State legislation appeared in 1909 in Rhode Island, covering smoke emission in cities over 150,000 population. Domestic

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*Mr. Mallette is a consultant on air pollution problems and is also executive secretary of the Committee on Air Pollution Controls, the American Society of Mechanical Engineers. He formerly was associated with the Public Health Service Occupational Morbidity and Mortality Study, 1935-37, Detroit. Mr. Mallette's original paper, which was somewhat longer, was presented before the 18th annual meeting of the American Power Conference, sponsored by the Illinois Institute of Technology and held at Chicago, March 21-23, 1956.*

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sources were exempted, as were locomotives at the time of starting and feeding fires while in roundhouses or yards.

Massachusetts, in 1910, introduced in its smoke control law a device for estimating smoke density which is still extant, namely, the Ringelmann chart. The chart was devised in the 1880's by a French professor of agricultural engineering and was first used in this country in 1899. With all its shortcomings, it is still widely used although several other devices have been introduced. The model ordinance published by the American Society of Mechanical Engineers, which has formed the basis for most municipal smoke abatement ordinances in this country, includes the Ringelmann chart.

For a number of years, New Jersey and metropolitan New York have been disturbed by interstate air pollution. Bills were introduced in the legislatures of both New Jersey and New York to institute an interstate survey, but until 1955, when New Jersey finally passed a matching bill, these had been passed only by New York. The New Jersey bill provided for an investigation of the area in question to determine whether an interstate air pollution problem exists and, if so, to recommend appropriate controls, an agency to apply them, and to suggest the draft of legislation necessary to implement the findings.

The Interstate Sanitation Commission was directed to undertake the study, for which New York and New Jersey each provided \$30,000. The terminal date for the presentation of findings and recommendations was set for February 1956. However, the investigation has been delayed because of legal complications over jurisdiction.

A joint resolution by both houses of the Congress signed August 3, 1956, by the President, approves the present bi-State arrangement in which the State of Connecticut, the third member of the Interstate Sanitation Commission, has acquiesced. Bills have been passed by both the New York Legislature and the New Jersey Assembly, updating and approving the commission's plans for proceeding.

Both Canada and the United States have shared concern over air pollution in two areas: one at Trail, B. C., from 1928 to 1935, and the other at Detroit, Mich., and Windsor, Ont., since

1950. The International Joint Commission undertook the Detroit-Windsor investigation, which originally was concerned with smoke from the vessels traversing the Detroit River. This joint interest in smoke control has been expanded into a comprehensive study to determine the effect of air pollution on almost every aspect of community life.

### Local Accomplishments

St. Louis was probably the first large city to make an effective reduction in smoke pollution. Before 1940, particularly in the winter, dense smogs were frequent occurrences. It was not uncommon there to have lights and headlights burning until noon. Now there is acceptable evidence to prove that a marked reduction in smoke pollution has been brought about by the city.

Essentially, this improvement was achieved through enactment and enforcement of an ordinance prohibiting the sale of high volatile coal in the city except in sizes under 2 inches. It was also required that all bituminous coal containing over 12 percent ash or 2 percent sulfur be washed.

### *Allegheny County*

For many years, efforts at smoke control in Pittsburgh had such little success that the place was widely known as the "Smoky City." Residents of Pittsburgh can truly testify to the density and irritating qualities of the "black days." Until the late 1940's, Pittsburgh was deteriorating in every way, but finally a great civic movement—the Allegheny Conference on Community Development—arose to resuscitate the decaying city. It was the force behind this great effort which brought about the change in the Pittsburgh atmosphere.

The details of the city of Pittsburgh and Allegheny County ordinances are too complex for a brief discussion. Based in large part upon the St. Louis ordinance, these ordinances brought about a marked reduction in the smoke content of the air, principally by increased inspection and enforcement and by restricting the volatile content of solid fuels. It should not be assumed, however, that a miracle has occurred and that there is no pollution left to be con-



trolled in Pittsburgh and Allegheny County: quite the contrary. Nevertheless, a truly remarkable improvement has been achieved. There are many technical problems left to solve, but, at least, attention is being given them. Under study are effective and economical control methods—especially for steel processes—which may replace conventional and costly equipment presently available.

### *Los Angeles County*

Los Angeles' smog began to appear as a serious problem during the industrial expansion and population growth of the World War II period. More than \$1 billion in new capital was invested from 1941 to 1950, and more than 5 million people were added to the population of Los Angeles County. People began to be aware of an irritation of the eyes and respiratory tract. This smarting of the membranes and lachrymation were associated with the presence of a noticeable haze. Two other features of the smog, whose relationship was not learned until later, were damage to vegetation, especially certain truck garden crops, and accelerated cracking of rubber, most noticeable in the sidewalls of tires.

Insistent public demand brought about the passage, in 1947, of a State enabling act which created control districts to be activated by any county that determined control to be necessary. At least 4 California counties have active districts, and several other districts have been authorized; there is one authorized 9-county group in which 6 counties are organizing.

The California State enabling act specifically and generally prohibits air pollution and provides for the establishment of local rules and regulations by each control district. Those of the Los Angeles Air Pollution Control District provide a permit system for both construction and operation of any equipment which may cause emission of air contaminants. Detailed plans and specifications must be filed before permits are granted for new construction or modernization. Under these provisions the district engineers have approved permits for well over \$100 million, of which over 15 percent is for control equipment. The rules also apply restrictions for specific pollutants such as

particulate matter, sulfur gases, and the solid products of combustion in excess of certain concentrations.

The Los Angeles County Air Pollution Control District, the enforcing body, has had a harried history. Although smog may occur during any month of the year, it is most prevalent during the late summer and the autumn and may even extend through December into January, as it did in 1953. In 1954, a 17-consecutive-day episode occurred during which public protest became uproarious. The board of county supervisors—the governing body—reorganized the agencies, providing for enforcement by strenuous prosecution. So many violations were cited that a special smog court was set up. However, in spite of the vigorous enforcement effort, on September 13, 1955, the worst smog ever recorded occurred. The lesson to be learned from the situation is that the problem of urban air pollution should be tackled in its potential state rather than when it becomes an actual and serious problem.

### *Other California Developments*

Two events in southern California are noteworthy. The first is the use of the Ringelmann chart to judge the opacity of plumes composed of other than black smoke, the original purpose for which the chart was devised. The other is the refusal of an operating permit for a steam power station because, among other reasons, of the high sulfur content of the fuel which it proposed to use.

Early in 1955, local courts affirmed violations of the opacity sections of the Los Angeles regulations wherein plumes of blue, yellow, or even white effluents were judged by inspectors making a mental translation of the Ringelmann chart. The United States Supreme Court has since refused to review, in effect thus supporting the finding.

In the other instance, the El Segundo station of the Southern California Edison Company was refused an operating permit on the grounds of the high sulfur content of the fuel proposed for use and of the inability to reduce the opacity of its plumes. Construction permits for additional proposed steam stations were also refused. As a result, the company has under-

*(Continued on page 1073)*

## Public Law 159—84th Congress

“ . . . it is hereby declared to be the policy of Congress to preserve and protect the primary responsibilities and rights of the States and local governments in controlling air pollution, to support and aid technical research to devise and develop methods of abating such pollution, and to provide Federal technical services and financial aid to State and local government air pollution control agencies and other public or private agencies and institutions in the formulation and execution of their air pollution abatement research programs. To this end, the Secretary of Health, Education, and Welfare and the Surgeon General of the Public Health Service (under the supervision and direction of the Secretary of Health, Education, and Welfare) shall have the authority relating to air pollution control vested in them respectively by this Act.

“The Surgeon General is authorized, after careful investigation, and in cooperation with other Federal agencies, with State and local government air pollution control agencies, with other public and private agencies and institutions, and with the industries involved, to prepare or recommend research programs for devising and developing methods for eliminating or reducing air pollution. For the purpose of this subsection the Surgeon General is authorized to make joint investigations with any such agencies or institutions.

“The Surgeon General may (1) encourage cooperative activities by State and local governments for the prevention and abatement of air pollution; (2) collect and disseminate information relating to air pollution and the prevention and abatement thereof; (3) conduct in the Public Health Service, and support and aid the conduct by State and local government air pollution control agencies, and other public and private agencies and institutions of technical research to devise and develop methods of preventing and abating air pollution; and (4) make available to State and local government air pollution control agencies, other public and private agencies and institutions, and industries, the results of surveys, studies, investigations, research, and experiments relating to air pollution and the prevention and abatement thereof.

“The Surgeon General may, upon request of any State or local government air pollution control agency, conduct investigations and research and make surveys concerning any specific problem of air pollution confronting such State or local government air pollution control agency with a view to recommending a solution of such problem.

“The Surgeon General shall prepare and publish from time to time reports of such surveys, studies, investigations, research, and experiments made under the authority of this Act as he may consider desirable, together with appropriate recommendations with regard to the control of air pollution.

“There is hereby authorized to be appropriated to the Department of Health, Education, and Welfare for each of the five fiscal years during the period beginning July 1, 1955, and ending June 30, 1960, not to exceed \$5,000,000 to enable it to carry out its functions under this Act and, in furtherance of the policy declared in the first section of this Act, to (1) make grants-in-aid to State and local government air pollution control agencies, and other public and private agencies and institutions, and to individuals, for research, training, and demonstration projects, and (2) enter into contracts with public and private agencies and institutions and individuals for research, training, and demonstration projects. . . .

“When used in this Act—

“The term ‘State air pollution control agency’ means the State health authority, except that in the case of any State in which there is a single State agency other than the State health authority charged with responsibility for enforcing State laws relating to the abatement of air pollution, it means such other State agency;

“The term ‘local government air pollution control agency’ means a city, county, or other local government health authority, except that in the case of any city, county, or other local government in which there is a single agency other than the health authority charged with responsibility for enforcing ordinances or laws relating to the abatement of air pollution, it means such other agency; and

“The term ‘State’ means a State or the District of Columbia.”

taken a \$1.75 million research program to find, hopefully, the answers to its difficulties.

### Federal and State Legislation

Several attempts at Federal legislation on air pollution followed the 1948 catastrophe in Donora, Pa. Last year, for the first time, there was major national legislation on this problem. Pertinent sections of Public Law 159 (84th Cong.), which became effective on July 14, 1955, are reproduced in the inset.

In general, Federal legislation aims toward research, cooperation with local agencies, and financial assistance to other groups rather than in the direction of enforcement. In some of these fields the Federal Government is already active. Early in 1955, the Public Health Service intensified its program of air pollution research and technical assistance to State and local agencies at the Robert A. Taft Sanitary Engineering Center, Cincinnati.

It is difficult to keep track of all statutes pending in State legislatures. However, at least 70 bills were considered by 12 State legislatures in 1955, but the number may well be 100. Almost 40 of the 70 bills were before the California Assembly. They provided, among other things, for the amplification of the present law for the formation of county air pollution control districts, for the creation of regional control districts, or for statewide control. One bill, passed to remedy the problem in the San Francisco Bay area, permits the creation of the 9-county district mentioned previously.

New Jersey passed a State air pollution control statute in 1954. Enforcement under this act has been in the hands of the bureau of adult and occupational health of the State department of health. Codes covering various air pollution problems are being formulated by the Air Pollution Control Commission, a body representing industry, the general public, the technical societies, and other responsible groups in New Jersey. The commission recently completed work on its first code—on the control of open fires and dumps, which are major sources of air pollution in the northeastern section of the State. The code went into effect May 1, 1956, and affects scrap dealers and others with unsatisfactory incinerators.

Other States which considered air pollution legislation in 1955 were Arizona, Michigan, and Virginia. The Michigan bill would create air pollution control districts. Virginia's and Arizona's bills were for statewide authority. One bill in the Arizona House of Representatives went to the extreme of proposing to prohibit "the construction of oil refineries or other smoke-producing industries within 15 or 20 miles of any city or town."

### Municipal and County Control

The tendency, in recent years, to convert from coal to oil or gas as a domestic fuel is helping to reduce smoke in urban atmosphere, but it does not completely eliminate it. A poorly adjusted oil burner can lay down a smoke screen worthy of a naval operation. Furthermore, high-sulfur oils contribute large quantities of sulfur dioxide to the atmosphere.

So many cities and towns have recently adopted or are presently considering smoke abatement or air pollution control ordinances that it is almost impossible to keep track of them. To mention a few:

Reno, Nev., Huntington and Wheeling, W. Va., Albuquerque, N. Mex., East Providence, R. I., Denver, Colo., Boyertown, Pa., Norfolk, Va., and Fair Lawn Borough, N. J., have all adopted new ordinances. Cleveland, Ohio, is modifying its present ordinance, and Charlotte, N. C., is reviving its old ordinance.

These are only isolated examples. However, the pattern of municipal legislation is much the same. In the absence of expert technical guidance, most local governmental bodies perforce use the scissors-and-paste method. They base their new ordinances on those of nearby or well-known cities or occasionally utilize so-called "model ordinances."

The typical city smoke control ordinance is relatively simple. It provides for the prohibition of black smoke of a given density (usually No. 2 Ringelmann) and forbids the emission of fly ash of a certain concentration (usually not exceeding 0.85 lb. per 1,000 lbs. of gases).

There is a trend, however, toward broader municipal air pollution control ordinances, based on the Los Angeles County ordinance as a model which prohibits the emission of all toxic

and nuisance effluents, with even specific levels for certain gases such as sulfur dioxide.

One of the most noticeable results of the Los Angeles smog activity has been a tendency for other areas to copy its regulations. Honolulu, Hawaii, is one; Louisville, Ky., was another, but then abandoned the idea and is presently embarked upon a comprehensive air pollution survey.

Elsewhere across the country there are current efforts to emulate the California model county control districts.

The county control-district type of air pollution agency will be more prevalent in the future. It solves the problem of control in the large city that is unable to control smaller, neighboring suburbs. For similar reasons interstate compacts probably will be employed to handle the problems faced by New York with pollution drifting from industrial New Jersey, by St. Louis with pollution drifting from the adjacent industrial areas across the river in Illinois, by Cincinnati with pollution from Kentucky communities, and by many other cities.

#### Cost of Control

The control of air pollution is not going to be cheap. In fact, it is going to be expensive. The cost of providing pure water or good sew-

age disposal was high in dollar outlay although not in relation to the advantage gained. It will be the same with pure air. But, as with water and sewerage costs, the outlay may be less than the cost of continuing pollution. This consideration provides the opportunity for a carefully planned program of education.

In many communities, educational programs are being assumed by the chambers of commerce. Programs may be undertaken by a college or university or in some areas by research organizations, such as Stanford Research Institute of California with its series of air pollution symposiums, Mellon Institute of Pittsburgh with its Industrial Hygiene Foundation meetings, the Air Pollution Foundation, the Southern Research Institute, and others.

Research organizations can aid also in the development of community educational programs by bringing to air pollution control a scientific and impartial point of view. Surveys and other studies will help in determining whether a pollution problem is real and whether the health considerations are transitory and superficial or chronic and basic. Research projects can be set up to study the nature of air pollution and how it can be best eliminated or controlled. These great economic, technological, and social issues challenge the statesman and legislator no less than the industrialist, scientist, and engineer.

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#### Mintener Resigns



Mr. Mintener

"It is a matter of deepest regret to me and, I know, to all my associates in the Department, that Bradshaw Mintener is resigning his position as Assistant Secretary of Health, Education, and Welfare.

"In the two years Mr. Mintener has held this post, he has made a great contribution to the work of this Department. The fine spirit of our organization, particularly in the field, is due in large measure to his activities. His sound advice on the problems of the Food and Drug Administration has been instrumental in laying a proper foundation for a greatly needed expansion of its activities which are so vital to everyone in the Nation.

"I am sorry Mr. Mintener could not stay longer in Government service."

—MARION B. FOLSOM,  
*Secretary of Health, Education, and Welfare.*

*Group therapy at the National Training School for Boys brings out into the open the warfare delinquents wage against adult society and the fears and hungers underlying it.*

## Group Therapy Behind Locked Doors

By SEYMOUR RUBENFELD, Ph.D., ROBERT SHELLLOW, Ph.D., and JACK L. WARD, M.D.

TO GIVE the reader some idea of the functions of the psychiatric unit in a juvenile institution, as well as some feeling for the types of problems faced in working with these youngsters, we shall attempt to describe the unit in the National Training School for Boys. The training school is for delinquent boys under the age of 18 who have been committed to the custody of the United States Attorney General. The school is operated in the District of Columbia under the auspices of the Federal Bureau of Prisons. We three, a psychiatrist and two clinical psychologists, form the psychiatric unit.

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*The authors are the three members of the psychiatric unit which they describe. Drs. Rubenfeld and Shelllow, the two psychologists on the staff of the National Training School for Boys, Washington, D. C., received their graduate degrees from Pennsylvania State University and the University of Michigan, respectively. Dr. Rubenfeld interned at Warren State Hospital and Hollidaysburg State Hospital in Pennsylvania. Most of Dr. Shelllow's earlier experience was with Veterans Administration hospitals at Ann Arbor, Dearborn, and Fort Custer, Mich. The third member, Dr. Ward, spent his internship and residency years at Delaware Hospital, Wilmington, and St. Elizabeths Hospital, Washington, D. C., before he was appointed acting chief of the NTS Psychiatric Service on April 1, 1955.*

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First of all, it is important to know what kinds of boys get into trouble and are sentenced to an institution of this type. Roughly, the boys with whom we deal fall into four categories.

Probably the most prevalent type is the boy we might call the predatory delinquent. His socioeconomic background is, more often than not, one of deprivation. His own family is usually large and disorganized. He may have experienced several foster home placements. The parental figures he has known may have bombarded him with the deepest kinds of rejection, ranging from exploitive overprotectiveness through cold indifference and neglect to sadistic hostility. He emerges from this trial of childhood with his ability to accept his dependence on others severely crippled. Estranged from adults, he sees them as persecutors. He throws himself against both adults and the social values and mores to which they conform. Adrift in the streets, he imbeds himself in the society of other adolescent outcasts. Here, he finds firm and uncompromising articles of conduct, the rules of the delinquent gang that sanction and codify ways of vengeance and means of exploitation.

Falling into a second group are boys who get into trouble for neurotic reasons. Many come from the middle class and often from upper middle-class socioeconomic backgrounds. Their families are frequently intact and may even be relatively well knit. These boys have



in these boys 24 hours a day. Supplement their understanding and offer suggestions for the handling of behavior problems. Occasionally incidents occur which demand consideration. For example, a boy may have a frank psychotic break, and it is necessary to transfer him to a psychiatric hospital. Usually, we have been placing a small number of disturbed boys on mood-ameliorating drugs such as Thorazine and Mellarin. These boys usually show obvious anxiety or some degree of depression as an aspect of their general adjustment in the institution.

Our major treatment effort is invested in group psychotherapy. Many acting-out adolescents are not amenable to individual psychotherapy. These boys immediately react in an uncritical and uncontrolled fashion to inner prompts. This basic one-to-one relationship is too threatening for them. Firmly embedded in their personality is overwhelming distrust of the adult and fear of losing their fragile identity. They seem to function better in a group. Many of them find support, strength, and comfort in a gang formation. The adolescent urge to conform can, in the group setting, be utilized by the therapist in working toward the therapeutic goal of self-examination and self-evaluation.

By using the group treatment process, we now see 45 boys in 5 groups, each consisting of 5 to 10 members. We try to keep about 8 boys in each group, finding that this number allows for the development of opposing factions within the group itself. Smaller groups do not appear to be so successful because they tend to be more clannish. For example, 4 boys may form their little clique in a group of 5 and completely drown out the lone dissenting voice. Larger groups are unwieldy and difficult to control.

### Getting a New Group Under Way

In selecting candidates for group therapy, we again employ the technique of the group interview. We call together anywhere from 8 to 10 boys, evoke response, encourage interchange of ideas, and observe the role that each adopts toward us and toward the other boys. In the course of the discussion, we explain our pur-

pose, outline the aims and the nature of group therapy, and leave to the individual boy the choice of joining.

We avoid taking into therapy boys who make absolutely no effort to contact adults. We have found that they are not interested in group therapy, and, if they do enter a group, they get little out of it and soon leave it. We also avoid bringing in boys who have a compulsive need to act out their slightest whim or fear. We have had trying experiences in which these extremists continually disrupt groups and bring therapy to a stop.

But we have no objection to acting-out if it is checkable. It is one of our basic stocks in trade. Almost all our boys display this characteristic to some degree, and we work with it. All we require is that a boy, in addition, have some capacity to think and to speak in the face of his own anxiety or frustration and that he be ready to admit that he has questions about himself.

Boys come to the groups voluntarily. If they are interested in joining after the group interview, we take them in on the condition that they will remain at least 1 month or for 8 sessions. If at any time they decide to leave, if they feel that they are not getting anything out of it, we usually ask them to continue for 2 or 3 sessions after they have requested termination.

What are the boys who come into group therapy like? First and foremost, they have an arsenal of suspicions concerning adults and in particular the therapist, who becomes the momentary focus for those concealed and sometimes overtly expressed attitudes. Each boy has his fallen god or goddess. The boys remember the disappointing experiences they have had with adults. They remember the inconsistency of treatment and the inability of adults to control them. The result is that they bring to any relationship with an adult a tremendous amount of hostility—a hatred and a vengefulness which are clouded and confused by strong needs for direction, guidance, and love.

One way in which this hostility is expressed can be seen in a boy's comments in his first group therapy session: "Why did you choose me? Why not leave me alone—I'm not crazy."

Later, this suspiciousness may show up as:





John snaps to them, "Aw, don't listen to him (the therapist). He doesn't really give a — either."

The whole group is stunned by this statement. George and Sam snicker uneasily. The therapist tries to get John to amplify his feeling, but before he can get more direct expression of hostility, the group slides deftly away and begins talking about custodial officers in general. The session ends with general griping about the institution.

The next session starts with John mischievously asking the therapist for a cigarette. When the therapist questions John about his relentless nagging for the cigarette, John blows up. "All the time you're asking why, why . . . we never get anything out of you." John suddenly sees himself as the anti-"Doc" hero, and it is obvious that he is enjoying the situation. He and George and Sam begin to giggle. John calls the Doc a "squealer" and accuses him of spying and making reports on everybody in group therapy. "You're yellow, Doc. You don't have any guts at all. You wouldn't last twenty minutes in prison."

Meanwhile, the therapist has observed Ritchie and Pete, among others in the group, no longer looking scared. On the contrary, Ritchie seems to show signs of "righteous indignation" at John's last statement. Ritchie says under his breath, "Aw, —."

The therapist notes Ritchie's reaction and says, "Group, what do you think of what we are hearing?"

Ritchie says derisively, "Don't listen to him, Doc, he's way off."

John turns on Ritchie with vengeance. "Who asked you, Punk? You're always eating somebody. What do you know about anything? You're just a clock (newcomer). You haven't met your six-piece yet (6 months' reclassification at which a boy can request a change in program)."

By this time, the lines of the battle are clearly drawn. Pete sides with Ritchie, and George with John. Others lean forward attentively. Ritchie counterattacks against John. "You're just taking it out on the Doc because you were stupid enough to get thrown in the jug. You always do this. Whenever you foul yourself up, you always blame it on somebody else."

At this point Ritchie and Pete begin to cite instances of John's asking for trouble, getting into it, and blaming others.

John retaliates by describing situations in which Ritchie has gotten away with things by "eating" (apple polishing) the officer and implies that Ritchie is trying to do that now with the therapist. The therapist says, as quietly as possible, "I guess someone wants to kick me, and someone else wants to suck me in, but it's pretty hard to tell who wants to do what."

The group goes suddenly quiet, and there is embarrassed laughter on both sides. John nervously tries to maintain his lead and at the same time turn the therapist aside. "Aw, Doc, we were only kidding, we were just trying to get your goat."

The therapist asks, "I wonder why?"

At last, John hits on a way to retreat without loss of face. "Here we go again: What, Why, When, Where. If the Doc was running 'You Asked for It' on TV, he would read the letters and then look out at the audience and say, 'Why should I?'" This amuses the group. Tension is broken, and the group as a whole runs from the dangerous challenge given by the therapist into humorous accounts of instances in which the question "Why?" would be ridiculous. The session ends with the therapist remarking, "I guess you'll be comfortable enough eventually to talk about yourselves."

### Clues to Delinquent Behavior

The conflict between members and therapist, and among members, comes up again and again in different contexts. Sometimes the therapist is successful in focusing on the feelings and disappointments the boys have experienced with their parents and other significant people in their past life. When this happens, he attempts to relate their feelings to the feelings they are experiencing toward authority in general and toward the therapist in particular.

Movement in and out of such crises is characteristic of our groups. The group is like a self-sealing innertube: Occasionally a boy or the therapist succeeds momentarily in puncturing the resistance of the group, and powerful feelings explode before the wall of denial fuses again. Through repetition of this kind of

"Why do you do this, Doc? What's in it for you? You must be a spy—it all gets back to the superintendent." Or: "You're just experimenting with us . . . nobody really gives a ——— about us. You bucking for Captain?"

It has been our experience that these attitudes are present in all boys but become expressed in various forms by different members of the group.

### Use of Group Dynamics

From the preceding description it may appear that there is an incessant war of boys against therapist. As a matter of fact, when one faction of the group becomes intoxicated with the power of their anti-"Doc" attitudes, others in the group will begin to defend authority and attempt to stem the tide of violence. At this point a polarity is set up within the group: Struggle for power or a civil war develops along the lines of a personal duel or of gang warfare.

The polarity emerges because of the deep hungers for an infantile protective relationship with the therapist and because of the resentments stirred in the more aggressive boys when the therapist does not offer this relationship. The group splits into factions because some boys can't afford to see the therapist attacked. The boy who is driven to defend the therapist when he sees the attack launched is afraid that the therapist will attack him. Despite this apparent alliance with the "Doc," the boy's reaction is still based on the fact that he has identical, though not quite so obvious, feelings against the therapist's authority.

The therapist, with his relative understanding of the situation, is generally not incapacitated by anger with those attacking him or taken in by those defending him. Attempting to recognize both of the antithetical reactions for what they really are, he bases his comments and interventions on the insight derived from his own natural responses. He stands his ground and attempts to lead from strength. As therapist, all his interventions are directed toward clarifying to the entire group the issue of their basic struggles with dependence.

The group dynamics described in the preceding paragraphs are probably best seen in the

actual transactions and interactions of a group therapy session.

### A Group Therapy Session

John has stolen 17 cars, was in 2 previous institutions, and makes his way by gambling, "couning," and setting up "strong arm" cliques to get what he wants. At the moment he has the center of the stage. He tells about a movie the boys saw on television in which a man paroled from prison can't make a go of it in society. Nobody will give the ex-convict a job; his friends avoid him; and jobless, friendless, discriminated against, he gets drunk one night and gets returned to the prison as a parole violator.

As John gets more and more worked up about the injustice of it all, George and Sam go from quietly ignoring the group in their card game to sparring and light body punching. Peter and Ritchie are quietly listening and watching the therapist's reaction.

The therapist notes John's involvement and says, "Well, John, you seem to feel that was a pretty dirty deal."

For the first time, John centers a challenging gaze on the therapist. "You're ——— right this was a dirty deal. Nobody ever gives a guy who has done time a chance."

"How come?" the therapist asks.

"They're all down on a guy like that, they hate his guts. They don't let you alone when you're on parole. You're just sitting on your porch, and the cops keep coming around your house every night, and they're always frisking you . . . they're always needling you."

George turns aside from his sparring and throws out, "And they're all like that, whether they're inside the prison or outside."

The therapist says in an offhand way, "You seem to feel that people are down on you."

At this point, John bursts out, "You said it, Daddy-o," and goes on to tell how a cottage officer "threw" him into a segregation unit for what John considered to be an unjust reason. George and Sam join in. They break off their sparring and recount similar "mistreatment."

The therapist turns to the boxers. "George . . . Sam, you seem to be getting hot under the collar about this too."

# Causes of Death Among College Students

—A Study of 209 Deaths at Yale University, 1920–55—

By HENRY M. PARRISH, M.D., M.P.H.

WHAT DISEASES and conditions kill our college students? How does mortality among them compare with that of the general population of the same ages? Are there specific diseases to which college students are more prone to succumb?

In answer to these questions, I submit the results of a study of deaths among the students at Yale University during the period 1920 through 1955. The causes of death among these students are set forth, and they are compared with the causes reported for other college groups and for the total population of the United States. It is hoped that these data will focus attention on some of the important student health problems and that they will emphasize the necessity for action on the part of colleges and universities in fulfilling their responsibility for student health needs.

## Study Materials and Methods

The files of the department of university health, the department of mental hygiene and psychiatry, and the alumni records office of Yale

University were the primary sources of information. A student death was defined to include students who died during the academic year or summer vacation and those on medical or psychiatric leave of absence who died within 1 year after withdrawal. Calendar years, instead of academic years, were used to record the year of death.

To confirm the death and to determine the cause, the individual medical records at the department of university health were examined first. For students who died as a result of suicide and who had been seen in the department of mental hygiene and psychiatry, the records of that department were studied.

The hospital and autopsy reports of 23 students who died from medical and surgical diseases, or their complications, at the New Haven Hospital were also examined. Several errors in the original data were found and corrected on the basis of these records. Autopsy findings were used to correct clinical diagnoses whenever such findings were available.

Much valuable information was obtained from the individual records of the deceased in the alumni records office. For most of the students who died, these records contained the date of death or of withdrawal for medical or psychiatric leave of absence and a statement of the cause of death from the registrar of vital statistics in the town where death occurred. For most of those who died from accidents or suicides, they also contained newspaper clippings concerning the incident.

The name of any student who could not be

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*Dr. Parrish is assistant physician, department of university health, Yale University. He was a fellow in public health at the university's School of Medicine from September 1955 to June 1956, when he received the degree of master of public health. This paper reports a study he made in partial fulfillment of the requirements for that degree.*

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crisis, there is a gradual sharpening of a boy's image of himself and a lessening of his hate. As he grows more comfortable with himself, he finds it less frightening to stand alone, and the need to blame and hate others for his own inadequacies abates. He is able to stand apart equally from attacks on, and defenses of, the therapist by the less advanced members of the group, and he can criticize both sides. He begins to talk openly about the personal consequences of his own experiences, and he begins to lay realistic plans for his future.

Group therapy not only provides a workable vehicle for effecting change in these adolescents

but also supplies many clues to the nature of the developmental processes producing delinquency. The reader may have observed that most of the diagnostic and therapeutic tools which we employ are not at all new. The interviews, diagnostic tests, and the therapeutic relationships are much the same as those used in the conventional psychiatric setting. We are entirely content with these techniques because, as yet, our knowledge of the delinquent is far from complete. The evaluation of our skills must wait upon the direction of resources toward a systematic observation of the rebellious adolescent.

## PHS Films

### Flocculation Test for Trichinosis

35 mm. filmstrip, color, sound, 11 minutes, 85 frames, 1956.

**Audience:** Laboratory directors and experienced laboratory technicians.

**Availability:** Loan—Communicable Disease Center, Public Health Service, 50 7th Street NE, Atlanta 5, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

The use of the modified bentonite flocculation test is the subject of this highly technical procedural film-

used and the complete procedures for the test, including reconstitution of the bentonite, preparation of the antigen, standardization of the reagents, and typical appearance of the flocculated particles.

### Poultry Hygiene Series: Plant Layout and Construction Operating Procedures

35 mm. filmstrips, color, sound, 10 minutes each, 73 and 83 frames, respectively, 1956.

**Audience:** State sanitarians, public health administrators, and plant operators.

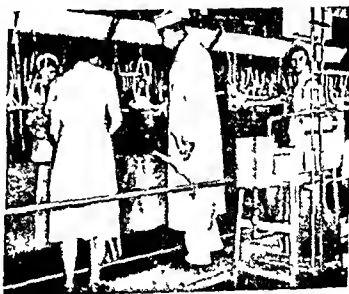
**Availability:** Loan—Communicable Disease Center, Public Health Service, 50 7th Street NE, Atlanta 5, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

These two films show the application of the 1955 United States Public Health Service Ordinance

and Code to (1) the construction and layout of a medium-sized plant and (2) operating procedures.

The first film is illustrated by a blueprint of a plant showing five main divisions: (a) receiving and holding room, (b) dressing room, (c) eviscerating room, (d) packaging room, and (e) refrigerating room. Typical operations and construction details pertinent to sanitation in each division are shown.

The second film illustrates the operational procedures in a typical



plant by a series of photographs of (a) poultry arriving from the farm, (b) ante-mortem inspection, and (c) step-by-step details of the cycle of processing poultry. Sanitary aspects are stressed in each operation: killing, defeathering, eviscerating, packaging, and storing or delivering to the consumer. The necessity for personal hygiene among the workers is emphasized.



strip. It is a simple, rapid, and specific test for the laboratory diagnosis of trichinosis.

The film depicts the materials

**Table 2. Comparison of number of deaths expected if national death rates had prevailed with number of deaths observed among Yale University students, 1920-55**

Year	National death rate per 1,000 population <sup>1</sup>	Number of students registered at Yale	Number of deaths expected	Number of deaths observed
1920.....	4.2	3,563	15.0	0
1921.....	3.4	3,875	13.2	7
1922.....	3.3	4,235	14.0	7
1923.....	3.4	4,490	15.3	7
1924.....	3.2	4,500	14.4	8
1925.....	3.2	4,796	15.3	9
1926.....	3.2	5,216	16.7	10
1927.....	3.0	5,438	16.3	6
1928.....	3.2	5,583	17.9	14
1929.....	3.2	5,663	18.1	5
1930.....	3.0	5,963	17.9	6
1931.....	2.9	6,049	17.5	1
1932.....	2.6	5,864	15.2	6
1933.....	2.5	5,723	14.3	7
1934.....	2.6	5,553	14.4	12
1935.....	2.6	5,418	14.0	10
1936.....	2.6	5,427	14.1	8
1937.....	2.5	5,488	13.7	4
1938.....	2.1	5,560	11.7	6
1939.....	2.0	5,692	11.4	7
1940.....	2.0	5,745	11.5	3
1941.....	2.1	5,719	12.0	2
1942.....	2.1	5,574	11.7	4
1943.....	2.5	5,267	13.2	2
1944.....	2.7	4,568	12.3	1
1945.....	2.6	3,709	9.6	1
1946.....	2.0	6,048	12.1	7
1947.....	1.8	8,862	16.0	5
1948.....	1.7	9,004	15.3	3
1949.....	1.6	8,768	14.0	16
1950.....	1.5	8,256	12.4	1
1951.....	1.6	7,716	12.2	3
1952.....	1.6	7,627	12.2	6
1953.....	1.6	7,558	12.1	4
1954.....	1.5	7,553	11.3	6
1955.....	<sup>2</sup> 1.6	7,555	12.1	4

<sup>1</sup> Rates for white males aged 15-24 years, published by the National Office of Vital Statistics in: *Vital Statistics of the United States, 1950*, vol. 1, p. 194; *Annual Summary for 1954*, part 2, *Monthly Vital Statistics Report*, vol. 3, No. 13, May 13, 1955; *Annual Summary for 1955*, part 2, *Monthly Vital Statistics Report*, vol. 4, No. 13, May 28, 1956.

<sup>2</sup> Estimated.

ues is statistically significant according to the chi-square test.

The vital statistics of the United States during the past half century reflect some striking changes in causes of death. Of the 10 leading

causes in 1900, 5 were communicable diseases. Pneumonia and influenza ranked first; tuberculosis, second; diarrhea and enteritis, third; diphtheria, ninth; and meningitis, tenth. In 1955, only one of these, pneumonia and influenza, was among the first 10 and none was among the first 5 (3).

To determine the trend in causes of death among Yale students, the numbers of deaths from accidents, infectious diseases (including pneumonia, meningitis, septicemia, tuberculosis, encephalitis, poliomyelitis, and others), and suicides were plotted for 10-year periods, as shown in the chart. Deaths due to infectious diseases have declined steadily. Accidents have remained at a high level and have been the most prominent cause of death in students since the decade 1930-39. The number of suicides rose sharply during the decade 1930-39, the depression years, then declined during the next decade, the war and postwar years.

## Discussion

The finding that mortality among the students at Yale University is generally much

**Table 3. Comparison of number of deaths expected if national death rates had prevailed with number of deaths observed among Yale University students, by cause of death, 1946-55**

Cause of death	National death rates per 100,000 population <sup>1</sup>	Number of deaths expected <sup>2</sup>	Number of deaths observed
Accidents.....	91.9	72.6	38
Malignant neoplasms other than leukemia.....	7.7	6.1	4
Diseases of the heart.....	5.8	4.6	1
Tuberculosis (all forms).....	4.3	3.4	0
Suicide.....	6.6	5.2	7
Pneumonia.....	2.6	2.1	1
Acute poliomyelitis.....	2.3	1.8	1
Cerebral hemorrhage.....	1.6	1.3	2

<sup>1</sup> 1950 rates for white males aged 15-24 years, as reported by Collins, Lehmann, and Trantham (ref. 2).

<sup>2</sup> Based on total student population of 78,947 for the 10-year period, as determined by adding annual registration figures.

traced by one of the above methods was submitted to the registrar of vital statistics in the town where death occurred. The deaths of 21 students were confirmed in this manner.

Information concerning the cause of death was obtained from one or more of the above sources for 207 of 209 student deaths. For one student who died abroad, death was reported as accidental without specific details, and the cause of death for another student could not be determined.

The data collected on each student death included the name and class of the student, the date of death, the age at the time of death, the cause of death, and the place where death occurred. Additional information on accidental deaths and suicides was obtained from newspaper clippings describing the circumstances of the death.

### Statistical Results

There were 209 deaths among the students at Yale University from 1920 through 1955, an average of slightly less than 6 each year. The only year in which no deaths occurred was 1920. The largest number of students died in 1949, when 16 deaths were recorded.

Of the 209 students, 86 percent were 15-24 years of age, 13 percent were 25-30 years, and 1 percent were over 30 years. Ninety-five percent were white males, and 5 percent were white females.

The five leading causes of death among the Yale students were accidents (43.8 percent), suicide (12.0 percent), heart and circulatory diseases (7.7 percent), pneumonia (7.2 percent), and infections of the central nervous system (6.3 percent). Of the accidental deaths, more than half were caused by motor vehicle accidents. The only other data available on deaths among college students are those reported by Diehl and Shepard from a study of deaths in 327 students at 9 universities during the period 1925-35 (1). In that study, the five leading causes were accidents (26.3 percent), heart and circulatory diseases (10.1 percent), suicide (8.0 percent), pneumonia (7.3 percent), and tuberculosis (6.4 percent). Again, motor vehicle accidents were the cause of more than half of the accidental deaths. The data on cause of death

**Table 1. Causes of death among Yale students, 1920-55, and other college students, 1925-35**

Cause of death	Yale students		Other college students; <sup>1</sup> percent of deaths
	Number	Percent	
Accidents.....	91	43.8	26.3
Automobile.....	49	23.6	15.9
All others.....	42	20.2	10.4
Suicide.....	25	12.0	8.0
Heart and circulatory diseases.....	16	7.7	10.1
Pneumonia.....	15	7.2	7.3
Infections of the central nervous system.....	13	6.3	4.6
Malignant neoplasms.....	11	5.3	2.8
Septicemia.....	7	3.4	4.6
Leukemia.....	6	2.9	1.5
Tuberculosis.....	5	2.4	6.4
Nephritis.....	5	2.4	1.8
Appendicitis.....	4	2.0	4.0
Other causes.....	10	4.8	22.4
Cause unknown.....	1	0.5	0

<sup>1</sup> Reference 1.

obtained in these two studies are given in table 1.

Since 95 percent of the Yale students who died were white males and 86 percent of them were in the 15-24 age group, the deaths at Yale are compared with the deaths among white males aged 15-24 years in the total population of the United States. From the national death rates for this group, the number of deaths expected among Yale students each year of the study period was calculated. The results, presented in table 2, reveal that the number of deaths at Yale was lower than the number expected for every year except 1949. That year an airplane disaster in Seattle, Wash., took the lives of 11 students.

To compare the causes of death among Yale students with the causes for the total population, 1950 rates for white males aged 15-24 years as reported by Collins and his associates were used (2). Since there was only one death at Yale in 1950, these rates were applied to student deaths during the period 1946 through 1955. As shown in table 3, for only two causes was the number of deaths among Yale students above expectation. They were suicides, with 5.1 deaths expected and 7.0 deaths observed, and cerebral hemorrhage, with 1.2 deaths expected and 2.0 deaths observed. Neither of these val-

information around which a preventive educational campaign can be constructed.

American colleges and universities have an obligation, a duty, to protect and promote the health of their students. Are our institutions of higher learning fulfilling this obligation? It is estimated from a 1953 survey of 1,157 colleges that of every 3, 1 has no clinical service, 1 has clinical services for minor disorders, and 1 has clinical facilities for both major and minor disorders (6). Thus, it appears that there is a definite need to stimulate the interest of administrators, teachers, trustees, and parents in health and medical facilities for college students.

### Summary

1. In a study of the 209 student deaths at Yale University from 1920 through 1955 the following were found to be the most common causes of death: accidents (43.8 percent); suicide (12.0 percent); heart and circulatory diseases (7.7 percent); pneumonia (7.2 percent), and central nervous system infections (6.3 percent).

2. Deaths from infectious diseases have decreased, but accidental deaths have remained high. Accidents have been the number one

killer of college students since the decade 1930-39.

3. The number of deaths among the Yale students was lower than would be expected if national death rates had prevailed. There were more suicides among the students than would be expected, but the difference was not statistically significant.

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- (5) Farnsworth, D. L.: Health on the campus. Bull. Nat. Tuberc. A. 42: 71-72, May 1956.
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## Porterfield Named Assistant to the Surgeon General

**Dr. John D. Porterfield**, a career officer of the Public Health Service since 1939, assumed his duties as assistant to the Surgeon General on October 16, 1956.

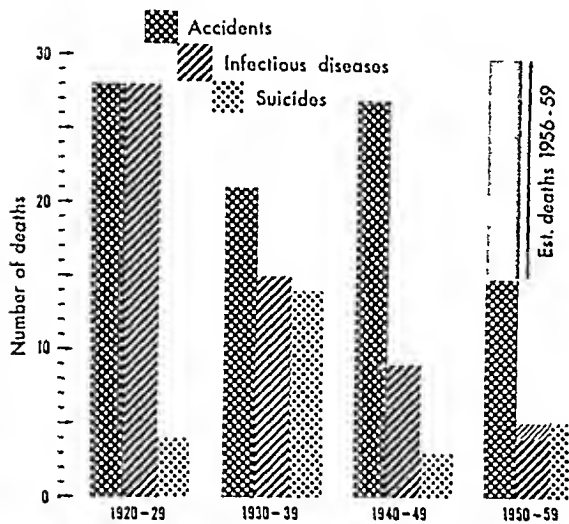
He comes to his new position from Ohio where he was director of the Ohio State Department of Health from 1947 to 1954 and director of the Ohio Department of Mental Hygiene and Correction since 1954.

In his new assignment, Dr. Porterfield will give particular attention to the fields of chronic disease and aging.

He is chairman of the editorial board of the American Journal of Public Health; chair-

man of the mental health section of the American Public Health Association; former secretary and later chairman of the association's health officers section; former secretary and later vice president of the Association of State and Territorial Health Officers, and a member of the Scientific Study and Planning Committee of the Joint Commission on Mental Illness and Health. He also is associate professor of preventive medicine at the Ohio State University Medical School at Columbus and a visiting lecturer at the University of Michigan School of Public Health at Ann Arbor.

**Number of deaths from accidents, infectious diseases, and suicide among Yale University students for 10-year periods, 1920-59**



lower than that of the general population of the same ages is not unexpected, for several reasons: College students, for the most part, are adolescents and young adults in good health. The majority of the students at Yale are from an average or an above average socioeconomic group. Most of them eat in the college dining halls, where well-balanced meals are served. Yale students are a selected intellectual group, who are probably better informed about health matters than the general population of the same ages. College entrance physical examinations help detect disease and single out for special care students with medical problems. Complete medical care is available to all students 24 hours a day, 7 days a week, while school is in session.

This study clearly points to accidents as the number one health problem among college students, just as they are in the general population in the age group 15-24 (4). At Yale, accidents accounted for more deaths than the next five most common causes combined. Accidental deaths have continued at a high peak, while deaths due to infectious diseases have been on the decline. There are no reliable statistics regarding the incidence of accidents at Yale, but preliminary data suggest that 1 Yale student in 4 has an accident requiring medical treatment each year.

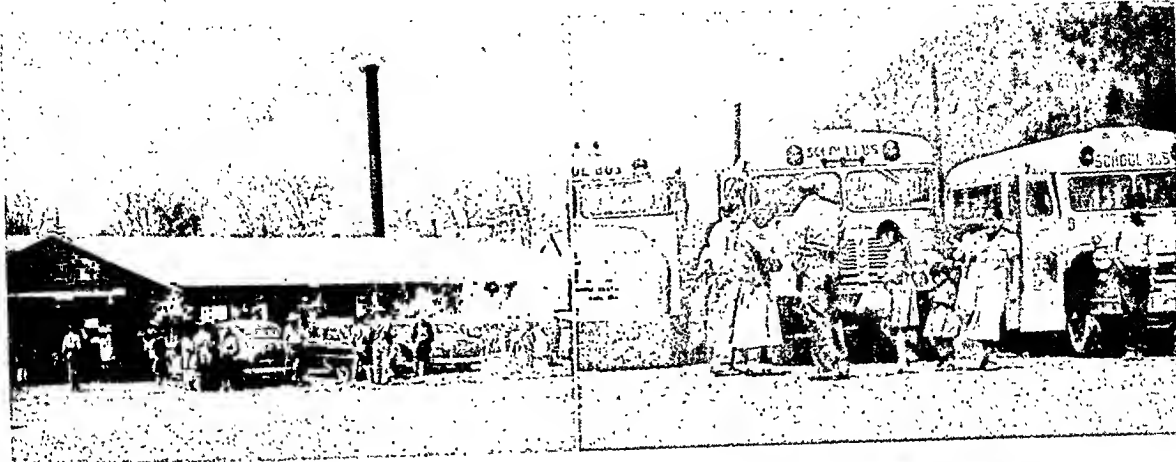
In the general population, motor vehicle accidents cause more deaths than any other type of accident among persons under 65 years of age (4). This proved true at Yale, where 23.6 percent of all deaths were caused by motor vehicle accidents. Most of the motor vehicle deaths occurred outside Connecticut, and most of the ones in Connecticut happened outside New Haven. Closely related to these findings is the fact that most of the fatal motor vehicle accidents took place over the weekend. Since Yale is primarily a men's college and since there are no girls' schools in the immediate vicinity, many of the undergraduate students travel long distances in automobiles over the weekend to see young ladies. Other students drive home to spend the weekend with their families.

Suicide was the second most common cause of death among Yale students. The number of suicides was highest during the depression years and lowest during and immediately following World War II, a pattern which is consistent with the pattern of suicidal deaths for the general population. There is no clear explanation for this phenomenon, but some authorities feel it is because the potentially suicidal individual diverts his thoughts, and his pent-up anger, from himself to the war effort and the potential enemy.

Most of the causes of death among college students are amenable to prevention and treatment programs. Communicable diseases are today readily controlled with antibiotics. Through health education, it should be possible to prevent many accidents. With the provision of adequate psychiatric counseling, it may be possible to reduce the number of suicides. Promotion of mental health is an important function of any college health department, since it has been estimated that about 10 percent of the students need professional help with their emotional problems (5).

The college situation affords unusual opportunities for a productive campaign against accidents. College students are in a learning situation; they are maturing individuals; and they are congregated together where they can be reached. As a result of this study of deaths at Yale, plans are now being made for an investigation of accident morbidity at the university. This investigation should provide





The survey site was the arts and crafts building located on the reservation at Cherokee Indian Village. Facilities for determining heights and weights, taking nutritional histories, and taking and processing blood samples were set up inside. Mobile X-ray units from the North Carolina State Board of Health were parked behind the building.

Indian Agency school buses carried many participants to and from the survey site. Entire families came and the scene rapidly assumed a festive air.

The weight and height of each participant was determined by volunteer workers. Results are being compared with a study of weights and heights of the Cherokees made some 30 years ago.

Nutritionists from the North Carolina State Board of Health recorded diet histories for all participants being screened for diabetes.

The participants queued up preparatory to entering 1 of 3 curtained-off areas where blood samples were drawn for diabetes screening, serologic tests for syphilis, and determination of serum vitamin levels.



# Cherokee Indian Health Survey

By CHARLES M. CAMERON, Jr., M.D., M.P.H.

oU L S J

These characters in the Cherokee alphabet mean "Are you well?" They are used as a greeting.

TO ASSESS health conditions among the Cherokee Indians in North Carolina, a multiphasic survey was conducted at the reservation in April 1955. It was a joint venture of the Bureau of Indian Affairs, the Public Health Service, the North Carolina State Board of Health, the Jackson-Macon-Swain District Health Department of North Carolina, and the University of North Carolina School of Public Health.

Participation in the survey was limited to reservation inhabitants 15 years old or over. During a 2-day examination period, about 1,000

of the 2,500 to 3,500 residents received the various tests. The entire group received chest X-rays and serologic tests for syphilis, as well as height and weight determinations. Those 15 to 25 years were examined for blood vitamin levels. Those 25 years or over were asked for information about their diets and received diabetes screening tests.

In addition to a team of workers from the Federal, State, and local health agencies, more than 50 volunteer workers from the reservation and surrounding communities participated in the survey. Success of the operation is credited to the excellent presurvey educational and informational program conducted by personnel of the district health department and the Cherokee Indian Agency.

Results from the survey confirm that the Cherokees in North Carolina enjoy a state of health superior to that of many other Indian groups in the United States. The health of this group compares favorably with that of other residents of the mountainous area along the Tennessee-North Carolina boundary.

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*Dr. Cameron, associate professor of public health administration, University of North Carolina School of Public Health, was director of the team of Federal, State, local, and volunteer health workers who planned and conducted the screening project at the Cherokee Indian Reservation. His avocational interest in photography has made possible this picture story of the project.*

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# Serologic Survey for Syphilis In Migratory Labor Camps Of Upstate New York

By EVAN W. THOMAS, M.D.,  
and JOSEPH GIORDANO, M.S.

**C**ASE FINDING of syphilis among migratory laborers has been a difficult problem. In New York State the same facilities for venereal disease control are available to migrants as to all residents of the State. However, many migrants do not know about these facilities. Even when they do, many are reluctant to use them unless incapacitated by pain or illness. Clinics, whether operated during the day or night, have not been a satisfactory means of discovering more than a portion of the syphilis believed to be present. Therefore, the policy adopted by the Public Health Service of providing funds for serologic surveys for syphilis to be conducted in the labor camps was welcomed in New York State.

New York is a large State, and migrant workers during the summer and fall months are scattered throughout, from Long Island to the most western counties. Since many of the camps accommodate less than 25 migrants, serologic surveys reaching all migrants in the State are obviously impractical. However, with proper planning, large numbers can be tested by conducting surveys in the larger camps. To accomplish this, the location and

census of labor camps must be known, and operations should be confined to areas where the least possible time is needed for travel from camp to camp. Sanitation officers of the three New York State districts in which the surveys were conducted were very helpful in providing this information and in planning contacts with the camp owners and managers prior to the actual surveys.

The efficiency of the campaign was greatly augmented by the full cooperation of the personnel in these offices. In the last analysis, however, the success of the survey depended on the personnel of the teams in the field. The young men and women composing these teams worked many more hours than the usual 40 in a week. They refused to be stopped by difficulties that could be overcome by additional planning and hard work. They worked well with each other and wasted little time. Had it been otherwise, the number of patients examined would have been much smaller.

## The Operating Teams

Starting July 11, 1955, and finishing September 23, 1955, two teams, consisting of a clerk and a nurse, or technician, set out in doing venipunctures, operated in camps located in eight counties of northwestern New York State. Blood was withdrawn from the migrants after they returned from the fields in the morning or while they were in camp on the night. With rare exceptions, the cooperation of migrants, 15 years of age or over, was easily obtained and operations within the camps usually started until 10:30 or 11 p. m. Owing to advanced notice, the workers were prepared for the visit at night, and little time was lost in getting underway after the team arrived. Frequently, each team visited several camps in a single night. During each working day, one of the members of the two operating teams visited the camps to be surveyed that night, thus assuring a good reception and a well-organized plan of operations for the night.

As the nearest serologic laboratory equipped to handle the increased volume of blood speci-

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Dr. Thomas is a consultant in venereal disease control, New York State Department of Health. From 1936 to 1955 he was director of the syphilis service in Bellevue Hospital, New York City. Among his publications on venereal disease is the book, "Syphilis: Its Course and Management," 1949. Mr. Giordano is a health program representative in the venereal disease control field, assigned by the Public Health Service to the New York State Department of Health.

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A Public Health Service officer assigned to the North Carolina State Board of Health took blood samples. Of 973 serologic tests for syphilis, only 5 were positive. Four of these cases were found to have had adequate treatment.

The Hewson Clinotron, loaned by the Public Health Service, was used in screening blood samples for elevated blood sugar. Of 761 persons over 25 years of age, 24 diabetes suspects were singled out. Followup on these is in progress.

Final step was a chest X-ray. More than 90 percent of the 1,020 persons examined were essentially negative. Of 31 persons selected for rescreening, 16 were found to have tuberculous infection, but all were in an inactive stage.



Blood specimens were frozen and then shipped to the University of North Carolina, where serum vitamin A and C determinations were done. Preliminary reports indicate that the group surveyed tends to have a lower plasma ascorbic acid level than certain well-nourished population groups in the northeastern States. The serum vitamin A levels compare favorably with results obtained in other regional surveys.

Although not participants in the survey, Cherokee youngsters exhibited great interest in the activities. The two pictured are watching their parents as they progress through the survey line.



tating reaction coming to our attention was in a woman who was hospitalized for "serum sickness."

### Test Results

Serologic test results were received for 5,176 persons of which all but 155 were nonwhite (table 1). The white persons tested, although temporarily living in labor camps, were not migrants from outside New York State. Among these 155, there was 1 reactor in 127 men and 1 doubtfully positive result in the 28 women, making an overall reactive rate of 1.29 percent. Both were in the age bracket 15-24. The man had received no previous treatment, and the woman was given additional therapy.

The overall reactive rate for the 5,021 non-

white persons was 22.59 percent. The rate of positive and doubtful reactivity for nonwhite women ranged from 4.92 percent in the small number of 61 girls under 15 years old to 41.12 percent in women aged 45-54 and was consistently higher than for men of all ages up to this point (table 2). For persons over 55, the rate for women was 28.6 percent compared with 41.9 percent for men. For all nonwhites, the range was from 3.39 percent in children under 15 years old to 43.41 percent for persons aged 55-64.

A slightly higher (although generally consistent) percentage of doubtful reports occurred among women than men. Experiences with the specific treponemal immobilizing antibody tests show that more biological false-positive serologic tests for syphilis are found in women

**Table 2. Results of testing for syphilis among nonwhite migrant workers in New York State, July 11-September 15, 1955**

Age (in years)	Male				Female			
	Number tested	Number positive	Number doubtful	Percent reactive	Number tested	Number positive	Number doubtful	Percent reactive
<15.....	57	1	0	1.75	61	2	1	4.92
15-24.....	1,131	46	20	5.84	595	46	20	11.09
25-34.....	747	113	45	21.15	470	103	38	30.00
35-44.....	679	146	54	29.46	329	92	37	39.21
45-54.....	434	118	45	37.56	197	55	26	41.12
55-64.....	206	67	27	45.63	52	15	3	34.62
65+.....	52	8	6	26.92	11	0	0	-----
Total.....	3,306	499	197	21.05	1,715	313	125	25.54

**Table 3. Disposition of reactors in nonwhite migrant workers in New York State, July 11-September 15, 1954**

Age (in years)	Number reactors	Number reactors examined	Brought to treatment		Returned to treatment		Adequate previous treatment		Number reactors not examined
			Number	Percent examined	Number	Percent examined	Number	Percent examined	
<15.....	4	3	2	66.67	1	33.33	-----	-----	1
15-24.....	132	112	79	70.54	17	15.18	16	14.29	20
25-34.....	299	254	148	58.27	33	12.99	73	28.74	45
35-44.....	329	295	169	57.29	60	20.34	66	22.37	34
45-54.....	244	221	128	57.92	51	23.08	42	19.00	23
55-64.....	112	107	56	52.34	14	13.08	37	34.58	5
65+.....	14	12	8	66.67	2	16.67	2	16.67	2
Total.....	1,134	1,004	590	58.76	178	17.73	236	23.51	130

Table 1. Results of testing for syphilis among migrant workers in New York State, July 17-September 15, 1955

Age group (in years)	White				Nonwhite			
	Number tested	Number positive	Number doubtful	Percent reactive	Number tested	Number positive	Number doubtful	Percent reactive
<15.....	8	0	0	0	118	3	1	3.39
15-24.....	51	1	1	3.70	1,726	92	40	7.65
25-34.....	36	0	0	0	1,217	216	83	24.57
35-44.....	36	0	0	0	1,008	238	91	32.64
45-54.....	14	0	0	0	631	173	71	38.67
55-64.....	6	0	0	0	258	82	30	43.41
65+.....	1	0	0	0	63	8	6	22.22
Total.....	155	1	1	1.29	5,021	812	322	22.59

mens was usually 20 to 60 miles from the headquarters where the teams were working, one of the team members motored to the laboratory each morning to deposit the specimens drawn the night before and to pick up reports on those that had been tested. In this way, workers found to have positive reports could be interviewed and treated, if necessary, within several days at the most after the blood had been withdrawn. Treatment was given by a physician or under the direct supervision of a physician. Although treatment was arranged at the shortest possible interval after blood was taken, it was impossible to find all migrants whose serologic tests were reported positive or doubtful. In some cases, blood specimens were taken from workers who were only visiting the camp on the night blood was withdrawn. In other cases, workers had transferred to another camp or were absent the night treatment was given. Repeated visits to a camp to find one or more seropositive cases were usually impractical. About 10 percent of the nonwhite persons with positive or doubtfully positive test reports could not be interviewed or examined for treatment.

### Treatment

In mass surveys of this kind, the advantages of examining and treating the largest possible number of persons must be weighed against the desire to maintain high standards of diagnosis. In the absence of clinics and the full cooperation of patients, thorough diagnostic examinations are impossible. In the migrant survey,

quality of diagnosis was frankly sacrificed for quantity. As a result, probable diagnoses were based largely on the report of a single serologic test for syphilis performed by a flocculation technique usually used only for screening purposes. Attempts were made to obtain histories from all patients with positive or doubtful test reports. The histories were frequently vague and unreliable. Therefore, we treated, on suspicion, most patients with doubtful tests for syphilis and no reliable history of previous adequate treatment.

Treated patients were given a card with the date and the kind and amount of therapy received. They were told to keep the card with their Social Security card or driver's license and to show it at future medical examinations. Even though some or many of these cards may be lost, unnecessary re-treatment might be avoided in numerous cases, if the practice of providing migrants with such a record of treatment were to become universal.

Treatment consisted of a single injection of 2,400,000 units of benzathine penicillin G, contained in a disposable syringe. This dose, concentrated in a total volume of 4 milliliters, caused varying amounts of pain and soreness at the site of injection. A few patients coming to our attention were incapacitated by pain for periods of at least several days. The single injection is convenient and it saves time, but complaints of severe pain would undoubtedly have been diminished or avoided had 1,200,000 units of a less concentrated suspension been injected into each buttock. The only other incapaci-

# The Use of the Membrane Filter Technique for Testing Water Supplies in the Field

By MALCOLM C. HOPE, Ch.E., M.P.H., and ARTHUR H. NEILL, C.E., M.P.H.

**T**WO STUDIES conducted in western national parks during the early summer of 1955 evaluated the feasibility of using the membrane filter field test laboratory to determine the bacteriological quality of the drinking water supplies in the national parks.

The many widely dispersed water supplies in the parks vary from small springs, infiltration systems, wells, or surface supplies to community-type systems. Although the conventional sanitary survey of any water supply system provides data on potential sources of contamination and general adequacy of treatment and distribution, routine examinations for bacteriological safety are needed. The results of such examinations also serve to guide the operation and provide a record which reflects the sanitary quality over an extended period.

Because of the relatively isolated location of many parks and their water supplies, it is often time consuming to collect and mail samples and await reports from State laboratories which may be several hundred miles away. Frequently, in the time between sample collection and examination, a change occurs in the character of the sample, and results may not always reflect the condition of the supply.

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Considering the relatively short season in many park areas, a method of performing a simple, rapid, field test to supplement regular laboratory examinations would be valuable.

The membrane filter technique was introduced into the United States from Europe in 1947. Considerable research has been conducted in the United States, including laboratory studies by the Robert A. Taft Sanitary Engineering Center of the Public Health Service, to develop the technique for the bacteriological examination of drinking water. The membrane filter procedure has been accepted as a tentative method in the 10th edition of Standard Methods for the Examination of Water, Sewage, and Industrial Wastes. Portable field test laboratories (MF kits) are available to run tests and obtain results in the field. The time required to obtain results with MF kits is approximately 18 to 20 hours as compared to 2 or 4 days, plus time in transit, with the standard dilution tube test.

## Initiation of Studies

Although evidence (1) indicated that the MF field kit might be used effectively with national park water supplies, it was considered desirable to run a trial under actual field conditions. The National Park Service requested that the Public Health Service perform special studies relating to the applicability of the membrane filter technique. A project proposal of the work and objectives was outlined. Two duplicate studies of

than in men, and an undetermined number of the doubtfully positive tests in this survey may not have represented a past or present syphilitic infection. As previously mentioned, when in doubt we usually treated without attempting further examination.

The difference between the percentages of reactive reports in the white workers who were not actually migrants and the nonwhite migrants is striking, but it must be recognized that the mode of life and socioeconomic status of migrants are peculiarly conducive to venereal disease. The laborers follow the crops in many sections of the country. They comprise a moving army without benefit of the discipline and living conditions provided to most armies. Many have had little or no formal schooling. Yet, migrant laborers are still an indispensable part of our agricultural economy, and their health is of national concern.

That some progress has been made in the general reduction of the reservoir of infectious syphilis among migrants may be inferred from table 3. While the older ages have the higher rates of reactivity, it is also true that a greater proportion of those reactors had either already been adequately treated for their infection or at least had once been under the care of a physician and had received some treatment. These data may show some past accomplishments, but the great majority (over 70 percent) of the re-

actors in the younger age groups had no treatment for syphilis. If syphilis is to be controlled, case finding in the younger age groups is essential. Bringing these younger migrants with reactive test results to treatment was in itself justification of the survey.

### Treatment for Gonorrhea

Due to the lack of privacy and also of time, male patients were not examined for urethral discharges in many of the camps. However, all migrants with such complaints or other illness were urged to report them. As a result, 95 males were treated with penicillin because of urethral discharges, and 24 female contacts of these patients were also treated.

### Summary

Reports of serologic tests for syphilis were received for 5,021 nonwhite migrants. Of these, 812 (16.2 percent) had definitely positive tests, and 322 (6.4 percent) had doubtfully positive tests. Histories of adequate previous treatment were obtained from 236 of the patients with positive or doubtfully positive tests. Of 155 whites examined, only one had a definitely positive test report, and one had a doubtful report. A total of 770 patients received penicillin therapy for presumed syphilis and 119 were treated for presumed gonorrhea.

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## Tranquilizing Drug Research

The Public Health Service has established the Psychopharmacology Service Center in the National Institute of Mental Health, Bethesda, Md. The center will assist in the development of scientifically sound nationwide research on tranquilizing and other phrenotropic drugs used in the treatment of mental illness. Technical and research advisory services will be provided to scientists.

Dr. Jonathan O. Cole has been appointed psychiatrist in charge of the center. He received his psychiatric training at the Payne Whitney Clinic of the New York Hospital, New York City. Following 2 years' service as an Army psychiatrist, Dr. Cole joined the staff of the Division of Medical Sciences, National Research Council, Washington, D. C., where he worked with its committees on psychiatry and stress.



nel apparatus, and wetting of membrane cultures in petri dishes in the thermos bottles because of leakage of parafilm tape supplied with the kit.

One major difficulty, which persisted throughout the course of the studies, concerned the method of incubation of the membrane filter cultures. Thermos bottles supplied with the kits are used for incubation. Under low temperature conditions prevailing during the studies, a significant drop in temperature, as much as 20° F. 4 hours after starting the incubation of cultures, occurred in these thermos bottles.

Although the exact effects of such variation from required incubation temperatures were not evaluated, evidence indicated that the results were adversely affected. More recent improvements in MF kits also provide built-in electrically heated incubators that are adaptable to battery or to standard power sources.

As many of the individual tests were performed where the samples were obtained, open air conditions interfered with the use of the kit. Turbidities were abnormally high in the surface supplies during the early period of the studies because of the spring runoff. Because of the turbidity, difficulty in filtering enough water to obtain significant growth was reported from both study sites. Also, on some samples sediment deposited on the membrane so spread bacterial growth that coliform organisms could not be identified or counted.

The use of dehydrated nutrient media pads was considered convenient and satisfactory. However, possible inhibition of coliform growth related to the use of this nutrient method was suspected in the Rocky Mountain Park study.

### Results of Parallel Tests

The determination of the agreement of the MF test with the standard dilution tube test was included in the studies. Temporary laboratory facilities and equipment to run the standard methods test were assembled in the parks. In addition, some samples were sent to State health department laboratories for examination.

Standard dilution tube tests were run on

### Comparison of results of parallel membrane filter and standard dilution tube tests applying the 95 percent confidence limit to the MPN obtained by the standard dilution tube test

Park study area	Number of samples	Number of samples agreeing	Number of samples disagreeing	Percent agreement
Rocky Mountain-----	69	56	13	81
Yosemite and Sequoia-----	54	50	4	93
Both studies-----	123	106	17	86

approximately one-third of all samples collected for examination by the membrane filter technique. With the standard dilution tube method, an estimate of the most probable number (MPN) of coliform organisms is calculated, and test results are reported in coliforms per 100 ml. of sample. In the MF test, a direct count of coliforms on the membrane filter are made, and results are also reported per 100 ml. of sample.

In comparing the results of the two tests on the same sample of water, the 95 percent confidence limit was applied to the standard dilution tube test results in recognition of the bias in the standard method.

In the present studies, the coliform counts obtained by the MF test were generally lower than those obtained by the standard dilution tube test. In some cases, the lower counts were caused by excessive turbidity that limited the amount of sample that could be filtered as mentioned previously.

The results of only 17 of the 123 total parallel tests were in disagreement by the two methods (table). The number of results in disagreement was higher in the Rocky Mountain National Park study than at Yosemite and Sequoia-Kings National Parks. Considering the difficulties encountered, the agreement of the two methods is deemed satisfactory and indicates that the membrane filter test results are reliable.

### Conclusions

1. The 86 percent agreement in the results obtained by the membrane filter technique and

approximately 6 weeks' duration were initiated in June 1955 in national parks. One study was conducted by John D. Eye, professor of sanitary engineering, Virginia Polytechnic Institute, in the Rocky Mountain National Park, Colo. The other study was conducted in the Yosemite and Sequoia-Kings National Parks, Calif., by Ely J. Weathersbee, instructor, Oregon State College. Both investigators, who are sanitary engineers, were called to temporary active duty from the Commissioned Reserve Corps of the Public Health Service.

In addition to studying the applicability of the membrane filter field test laboratory, they conducted sanitary surveys of water supplies sampled for examination by the MF kit. These surveys included inspections of the collection, treatment, and distribution systems of each water supply and a brief study of the drainage areas. In separate reports, the investigators have correlated the results of the bacteriological tests with the sanitary surveys.

#### Materials and Methods

The MF kit contains the necessary equipment for filtering and incubating the samples and sterilizing the funnel assembly in a rugged, portable carrying case which weighs 30 pounds fully loaded. Membrane filters and dehydrated nutrient media pads were used in the studies. Packs, each containing sufficient membranes and media for six tests, were purchased pre-sterilized in sealed polyethylene bags.

Additional items of equipment were found to be necessary for the tests. These included bottles for collecting water samples and storing sterilized dilution water, hand magnifying lens to assist in counting coliform colonies, improved plastic tape for sealing petri dishes prior to immersing in the thermos bottle incubators, and 95 percent ethyl alcohol for dipping the forceps tips prior to flaming.

The collection of samples and the examinations were conducted in accordance with the procedures outlined in the 10th edition of *Standard Methods for the Examination of Water, Sewage, and Industrial Wastes*. Parallel standard dilution tube tests were run on approximately one-third of all samples collected and results obtained by the two methods were

compared. The comparison was made to determine the degree of correlation of the MF kit field results with the standard dilution test results.

Briefly, the MF technique is to filter, under suction, a water sample portion through a small (2-inch diameter) circular, paper-thin disc composed of a cellulose material with pore openings of submicron size (1). Any bacteria present in the sample collect on the surface of the filter. The disc is transferred to a petri dish containing an absorbent pad with a small amount of nutrient broth culture media. A small quantity of sterile water is added to the petri dish which is then sealed and incubated in thermos bottles, provided in the MF kit, at approximate body temperature 37° C. After 18 or 20 hours, the dishes are removed from incubation, and those colonies exhibiting a metallic sheen, characteristic of coliform organisms, are counted. Results are recorded as the number of coliform organisms per 100 ml. of sample. Absence of coliforms indicates freedom from contamination.

Usually, in the Rocky Mountain National Park study, the MF kit was taken to the water sampling site where the test was performed. During inclement weather, the field laboratory was established in a ranger dormitory kitchen made available by the park superintendent. A home-type pressure cooker and a small electrically operated incubator were utilized for the standard dilution tube test and also for sample bottle sterilization. In Yosemite, the field laboratory was set up in the sewage treatment plant laboratory where a home-type pressure cooker was available for necessary sterilization of sample bottles, preparation of dilution tubes, and production of sterile water for use in rehydrating nutrient absorbent pads. Both investigators were assisted by park officials in locating water supplies and in obtaining the use of park equipment and facilities.

The MF kits, reputedly among the best available at the time of the studies, were ordered shortly before the initiation of the field work. Despite mechanical difficulties experienced with the MF kits early in the studies, the equipment performed in a satisfactory manner after adjustments. Most of the difficulties were related to ill-fitting petri dish holders, leakage of fun-

centration caused only partial inhibition of growth. The approximate mean colony count per tube in the control cultures was 300.

In the second test a stock solution containing 1 percent diamine, 1 percent sodium hydroxide, and 4 percent Triton X-100 in 60 percent isopropyl alcohol was diluted in distilled water to 1:1,000 and 1:5,000 diamine concentrations. Films were immersed for 10 minutes and were finally shaken in water before culturing. Growth inhibition was complete at the 1:1,000 dilution and two guinea pigs were negative for tuberculosis. At the 1:5,000 dilution growth inhibition was marked but incomplete and both guinea pigs were positive for tuberculosis. The approximate mean colony count per tube in the control cultures was 100.

These experiments illustrate the range in which diamine has caused complete inhibition by the dried sputum film technique, when weak sodium hydroxide was present either in the original diamine formulation or in the final diluting fluid. In the first experiment diamine proved definitely less effective when tested in the absence of sodium hydroxide.

Two representative experiments illustrating the whole sputum test technique are summarized. A tuberculous sputum pool, which yielded over 1,000 colonies per control slant, was used. Exposure to diamine was 30 minutes at 20° C.

In the first test diamine was diluted in water or in 0.1 percent sodium hydroxide from a 1 percent diamine, 10 percent isopropyl alcohol stock solution, and mixed with equal volumes of undiluted sputum. The final diluent before inoculating cultures and guinea pigs was water without sodium hydroxide but containing 1:6,000 potassium ricinoleate. Control sputum plus water contacted 1 percent sodium hydroxide in the final diluent to control contaminants before culturing.

A 1:625 final dilution of diamine without sodium hydroxide caused a moderate but not complete inhibition of *Mycobacterium tuberculosis*, and two guinea pigs were positive. However, it prevented all growth of contaminants. A 1:1,250 dilution also completely inhibited the contaminants but had no effect on the tubercle bacilli. A 1:2,500 diamine dilution no longer affected the contaminants.

When diamine was diluted in weak sodium hydroxide, it completely inhibited tubercle bacilli and contaminants at a 1:1,250 final dilution with two negative guinea pigs. At 1:2,500 it markedly but not completely inhibited *M. tuberculosis* and two guinea pigs were positive, but it still completely inhibited contaminants. Contaminants were no longer affected at 1:5,000.

In the second experiment (see table) final dilutions of 1:2, 1:10, and 1:50 of the same highly positive sputum contacted diamine which was diluted from a 2 percent diamine, 95 percent isopropyl alcohol stock solution throughout the test ranges with distilled water only. Before culturing, one portion of each diamine-sputum mixture was diluted 100 times in water containing 0.05 percent potassium ricinoleate. Cultures were inoculated 45 seconds later and duplicate cultures were made after the other portion of each mixture had been diluted in 0.05 percent potassium ricinoleate containing 1 percent sodium hydroxide. This technique in a whole sputum test minimizes the action of sodium hydroxide, save for its effect on contaminants. The sputum-water controls were cultured 45 seconds after dilution in 1 percent sodium hydroxide.

In the table the growth inhibiting capacity of

**Whole sputum test with diamine (N-dodecyl-1, 3-propanediamine) using 3 sputum dilutions**

Final sputum dilutions in test	Highest final diamine dilutions causing complete growth inhibition of			
	<i>Mycobacterium tuberculosis</i> —diluent before culturing contained		Sputum contaminants—diluent before culturing contained	
	No NaOH	1 percent NaOH	No NaOH	1 percent NaOH
1:2-----	<sup>1</sup> 1:250	1:500	1:1,000	<sup>2</sup> 1:2,000
1:10-----	1:1,000	1:1,000	1:4,000	<sup>2</sup> 1:32,000
1:50-----	1:4,000	1:4,000	1:16,000	<sup>2</sup> 1:64,000

<sup>1</sup> This final diamine dilution contained just under 20 percent by volume isopropyl alcohol which undoubtedly reinforced the 1:250 diamine action. The alcohol concentration in the other diamine dilutions is considered inconsequential.

<sup>2</sup> Not run at higher dilutions.

of such sputum, spread over 2 x 3 cm. rectangles on cover slips, were dried in the dark, generally at room temperature. Stained films from different pools showed from approximately 5 to more than 100 single acid-fast rods or small clumps per oil immersion field.

For the test, usually run in duplicate, a film was dropped into 40 ml. of diamine, held for the desired time at 20° C., quickly rinsed in 40 ml. of water to remove excess disinfectant or in a like volume of sodium ricinoleate to further neutralize some disinfectant (3), and then dropped into 40 ml. of water or weak sodium hydroxide containing glass beads. Hard shaking broke the cover slip and dispersed the film. This film-containing liquid was cultured on 3 slants, generally Loewenstein-Jensen medium, in 0.1 ml. volumes. Control films contacted water instead of diamine and were finally shaken in weak sodium hydroxide, before culturing, to inhibit the growth of contaminants. A maximum 0.25 percent of a film or 0.000125 ml. of original sputum was inoculated on each slant, which generally produced over 50 colonies in every control culture. Unfortunately diamine often dissolved rather large fractions of the films, so that culture inoculums tended to be below the stated maximum.

Guinea pigs were sometimes inoculated subcutaneously in parallel with cultures using volumes as large as 5 ml. or a maximum 12.5 percent of a film.

### *Whole Sputum Test*

A measured volume of diamine (double the desired final concentration) was added to an equal volume of sputum, thoroughly shaken and held at 20° C. or room temperature for 30 minutes with intermittent agitation. It was then quickly diluted 100 times in water or weak sodium hydroxide and inoculated in 0.1 ml. volumes on culture slants. Guinea pigs were sometimes also given much larger subcutaneous inoculums. The final diluent sometimes contained small amounts of potassium ricinoleate which somewhat checked the action of diamine but had no demonstrable effect on the growth of tubercle bacilli. Control sputum plus water was finally diluted in 1 percent sodium hydroxide to control contaminants.

The advantages of this test were:

1. A known amount of sputum went completely through the test.
2. It was easy to run.
3. Four times as much original sputum (0.0005 ml.) was planted on each slant as the maximum culture inoculum (0.000125 ml.) in the dried sputum film test.

The disadvantage of the whole sputum test, apparently not a major one with diamine (3), was that 1 percent of the test dilution of disinfectant went through to the final culture.

### *Diamine on Concrete or Glass Surfaces*

Two techniques were employed on concrete or glass surfaces. In one, 3 x 4 cm. rectangles on concrete or glass were contaminated with sputum which was allowed to dry. They were later covered with varying diamine dilutions. In the other, diamine was applied and allowed to dry and sputum was later placed over the same areas and allowed to dry. Care was always taken to keep the sputum boundaries within the diamine areas. These techniques were performed at room temperature. Sputum only was placed on control areas.

For the test a sterile swab was dipped into water or weak sodium hydroxide, rubbed over a rectangle and rinsed in the original fluid. This was repeated several times and cultures were then inoculated from the rinse fluid. Guinea pigs were also injected in one experiment. Control areas were swabbed with and rinsed in weak sodium hydroxide.

### **Results**

A number of experiments with the dried sputum film technique pointed in the same direction. Two such tests are summarized. In the first test a 1 percent diamine stock solution in 50 percent isopropyl alcohol without sodium hydroxide was diluted in distilled water to 1:2,500 and 1:5,000 diamine concentrations. Films contacted these dilutions for 30 minutes. When films were shaken in 0.5 percent sodium hydroxide as the final diluent before culturing, 1:2,500 diamine caused complete growth inhibition and 1:5,000 produced marked but incomplete inhibition. When water was used as the final diluent, however, the 1:2,500 diamine con-

dilutions. The concrete rapidly absorbed most of the diamine before drying, but diamine concentrated on the glass surfaces by evaporation. The surfaces were stored in the dark at room temperature for 11 days, then like areas were prepared and allowed to dry for 4 hours. At this time sputum containing tremendous numbers of tubercle bacilli was diluted 10 times in water and placed in 0.05 ml. volumes on each treated area and on untreated control rectangles. The surfaces were stored overnight in the dark. Half of the treated surfaces were then swabbed 3 times and rinsed in 10 ml. of water and immediately inoculated on 3 cultures, while the other treated areas went through 0.5 percent sodium hydroxide before culturing. Some guinea pigs were inoculated from the concrete surface mixtures at the time that cultures were made. Half the control areas were treated with 0.5 percent and the remainder with 1 percent sodium hydroxide.

Control cultures from both glass and concrete developed over 200 colonies of *M. tuberculosis* per slant and many of these cultures from concrete also showed non-acid-fast contaminants.

None of the glass surfaces, including control areas, yielded growth of non-acid-fast contaminants. Cultures from glass areas on which sputum had been placed 4 hours after diamine were also all negative for *M. tuberculosis* through the 1:3,000, or highest diamine dilution.

When diamine had remained on glass for 11 days before sputum was added and the areas were swabbed and diluted with sodium hydroxide, growth of tubercle bacilli was completely inhibited by the 1:300 and 1:1,000 and almost completely inhibited by the 1:3,000 diamine dilutions. When water was used for final swabbing and dilution, complete growth inhibition was produced by only the 1:300 concentration of diamine. Dilutions of 1:1,000 and 1:3,000 caused marked and moderate degrees of inhibition, respectively.

Results of this test on concrete were disappointing. Probably insufficient volumes of diamine were applied, which mostly soaked into the concrete and was no longer available to contact the sputum.

Diamine on concrete in 1:300 concentration

for 4 hours completely inhibited growth on cultures and 4 guinea pigs were negative for tuberculosis. The 1:1,000 strength caused marked though not complete inhibition when swabbed and rinsed with sodium hydroxide but only moderate inhibition when treated with water.

Diamine on concrete for 11 days gave only a moderate degree of inhibition under both methods of final swabbing and dilution at 1:300, and 2 guinea pigs were positive for tuberculosis. No evidence of activity was apparent for the 1:1,000 concentration.

### Toxic and Sensitizing Properties

A few preliminary tests on toxicity, skin irritability, and sensitizing properties of diamine were performed.

Intravenous injection of diamine into mice caused rapid death in a dose of 150 mg./kg., but 30 and 60 mg./kg. were tolerated and the mice appeared healthy 3 days later. Diamine was rather irritating by intraperitoneal injection, in doses as low as 40 mg./kg., into mice and killed all animals tested within 24 hours.

Two guinea pigs received 1 to 1.5 ml. of 1:300 diamine by stomach tube, lost weight for several days, and died. Another pig given a like volume of 1:1,000 diamine survived and gained weight for 2 months.

Diamine was not found to be unduly irritating to the skin in dilutions that might be used for practical disinfection. One volunteer rinsed his hands with 1 to 0.2 percent diamine many times for more than a year and has often allowed it to dry without any effect other than a slight tingling sensation. A 10 percent solution, allowed to dry on the forearm, produced a mild inflammatory reaction followed by slight desquamation.

Diamine is definitely irritating on intracutaneous injection. This was shown in two guinea pigs which, however, failed to develop measurable skin sensitivity to diamine under the following conditions. They first received 0.05 ml. intradermal diamine doses in 1:100, 1:300, 1:1,000, 1:3,000, and 1:10,000 dilutions. The 1:3,000 strength caused a minimal necrosis and this dose was repeated 3 times weekly until 9 such injections had been given. After a 19-day rest another 1:3,000 dose caused reac-

diamine against sputum is shown to be a function of the amount of sputum contacted by the germicide. This is a rigorous test considering the high content of organic matter and tubercle bacilli in this sputum. There were over 200 colonies per control tube for sputum diluted 50 times. Under practical conditions contamination with the quantity of tubercle bacilli represented by even the 1:50 dilution would be the exception.

The brief contact of the 1:2 and 1:10 sputum controls with 1 percent sodium hydroxide almost, but not completely, checked the growth of non-acid-fast organisms in cultures from these specimens (not shown in the table). The same contact for all diamine-treated sputums caused complete decontamination, which indicates that even the most dilute diamine employed had some effect on these extraneous organisms. This test again shows that diamine works more effectively against contaminants than against *M. tuberculosis* in sputum.

The effect of diamine on concrete surfaces was evaluated in three experiments. Fairly rough and absorbent concrete stepping stones were used. The pH of concrete, determined by swabbing areas with water and rinsing the swabs in the same water several times, approximated 9.0 in a number of tests, and these surfaces were also shown to have some buffer capacity. This should theoretically make concrete a favorable surface for decontamination by diamine.

The effect of sodium hydroxide was definitely exaggerated in the first two experiments, which is considered permissible because one can well use sodium hydroxide with diamine when disinfecting a concrete floor.

In the first experiment 0.2 ml. volumes of sputum were applied to the rectangles. Considerable sputum soaked into the concrete and drying was rapid. After the sputum had dried, 2 ml. of a turbid aqueous diamine suspension was flooded slowly over each rectangle during a 3-minute period. The diamine was spread evenly with a swab as it was applied. Much of it was absorbed by the concrete and the swab removed most of the excess. After 20 minutes a new swab was dipped into 40 ml. of 0.25 percent sodium hydroxide, the rectangle was swabbed, and the swab rinsed in the sodium hydroxide. This was performed 5 times and the

resultant mixture of diamine, sputum, and sodium hydroxide was left at room temperature until all areas had been treated and swabbed, then 6 cultures were inoculated from each mixture. Control areas were flooded with water instead of diamine and likewise swabbed into sodium hydroxide.

The test was run on duplicate concrete surfaces, and the cultures of control areas developed over 300 colonies per tube. The highest dilution of diamine that caused complete growth inhibition was 1:5,000 for one surface and 1:2,500 for the other. In the latter instance 1:5,000 diamine produced almost complete inhibition.

In the second experiment 1:500 and 1:5,000 aqueous diamine dilutions in 1.5 ml. volumes were slowly flooded on concrete rectangles and allowed to dry. Two hours later 0.05 ml. amounts of positive sputum were spread over the treated and control areas and were left overnight at room temperature. The test was completed on the next day as in the first experiment.

Control colonies approximated 50 per tube, but no growth appeared in cultures from the 1:500 and 1:5,000 diamine-treated rectangles. This experiment also contained tests with 1:500 diamine made up in half saturated urea and further diluted to 1:5,000 with water, and 1:500 diamine in 2 percent Clorox which was likewise further diluted. Urea favors diamine solution and, as dried urea is slightly deliquescent, it was thought that this mixture might be more effective than aqueous diamine only. This was not proved although diamine in urea also caused complete inhibition at 1:500 and 1:5,000 concentrations. The diamine-Clorox mixtures were incompatible and separated. Even the preparation of 1:500 diamine and 2 percent Clorox failed to cause complete inhibition of growth.

The last experiment was planned to test the residual action of diamine that had been dried for varying periods on concrete and glass surfaces and to minimize the effect of sodium hydroxide. Diamine was diluted in water, from a clear stock solution of 2 percent diamine in 99 percent isopropyl alcohol and 3 percent Triton X-100 to final concentrations of 1:300, 1:1,000, and 1:3,000. Rectangles on glass and concrete were flooded with 0.25 ml. to 0.4 ml. of these

action. It inhibits the growth of sputum contaminants more effectively than that of *Mycobacterium tuberculosis*. Its activity against bacterial spores, however, is not known.

Diamine does not appear to be an undue skin irritant. While no sensitizing ability was found, this possibility should be kept in mind. It appears promising as a surface disinfectant for tuberculosis hygiene and probably for more general sanitation also.

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## Record Number Rehabilitated

A record number of 66,273 handicapped persons were restored to productive employment through the State-Federal vocational rehabilitation program during the fiscal year ending June 30, 1956.

This was the highest total since the start of the public rehabilitation program in 1921 and was about 14 percent above the 57,981 rehabilitated in fiscal 1955.

The record figure includes 65,640 persons restored to employment directly through the State-Federal vocational rehabilitation program. The other 633 persons were placed in jobs through specific projects such as rehabilitation centers and shelter workshops developed jointly by community organizations and State rehabilitation agencies and financed, in part, by Federal grants.

Of the total rehabilitated last year, approximately 3,500 entered such "shortage" professional fields as education, medicine, and engineering. About 8,200 are in skilled trades, and approximately 6,200 work on farms. Most of the others are in managerial, sales, and service jobs or in unskilled work.

Roughly 13,000 of those rehabilitated had been dependent on public assistance immediately prior to or during the rehabilitation process and had been receiving approximately \$11.1 million a year in aid payments. The total cost of rehabilitating these people was \$9.2 million.

More than 48,000 of the rehabilitants were unemployed at the time they began receiving rehabilitation help, and most of the others were in unsafe, part-time, or otherwise unsuitable jobs or were in danger of losing their jobs because of disability.



tions indistinguishable from previous responses to this concentration (4).

### Diamine Compared With Phenolic Disinfectants

Sputum film tests have been run in this laboratory on several phenolic disinfectants (5). Exposure of films to disinfectants was 30 minutes, and the final diluent contained 0.25 percent sodium hydroxide. The highest dilutions of three representative phenolic preparations that caused complete growth suppression were:

Liquor Cresolis Saponatus U.S.P. 1:200.

Lysol (Lehn & Fink Products Corp.) 1:200.

Amphyl (Lehn & Fink Products Corp.) 1:400.

As shown in the present report, 1:2,500 diamine produced complete growth inhibition under the same conditions excepting that the final diluent contained 0.5 percent sodium hydroxide.

### Conclusions

Under natural conditions of contamination and infection, *Mycobacterium tuberculosis* is always accompanied by exudate. N-dodecyl-1,3-propanediamine (diamine) is shown to be an efficient disinfectant of tuberculous exudate. This is especially true when diamine is incorporated in weak sodium hydroxide. The evidence was developed by rigorous methods in which cultural results have been supported by animal infection tests.

Diamine has an even greater growth inhibiting power for sputum contaminants and also, from unreported experiments, for heavy concentrations of *Escherichia coli* and *Micrococcus pyogenes* var. *aureus*. Hence, it can be considered a growth inhibiting agent with a wide antibacterial action although its effectiveness against spore formers is not known.

The dried film and moist sputum testing procedures imitated the two varieties of contamination likely to occur. Each method has advantages and disadvantages. That the results using either technique were not far apart makes it possible to obtain the advantages of both. Thus, washing diamine from the film did not reduce its effectiveness, and the somewhat uncertain findings for film disinfection by

diamine plus sodium hydroxide were corroborated in the surer moist sputum technique.

The experiments with the use of diamine on contaminated surfaces, limited to concrete and glass, suggest that similar results might be expected for other smooth, inert, or alkaline surfaces.

It seems reasonable to employ the sodium hydroxide-containing preparation at a diamine dilution of 1:1,000 for heavily contaminated articles such as specimen bottles and emesis basins. For less heavily contaminated areas such as floors in the immediate vicinity of patients, bed frames, bedside tables, and laboratory surfaces, a dilution of 1:2,500 is suggested. A dilution of 1:5,000 would seem adequate for surfaces possibly, but not probably, contaminated, such as sanatorium and hospital floors and counters in general. A minimum contact period of 30 minutes is recommended.

If applications to fixed surfaces are not rinsed but allowed to dry in situ, an additional advantage should be gained. A smooth, inert, or alkaline surface mopped twice weekly should maintain a considerable disinfecting potential, especially if soap is not employed.

Sodium hydroxide should be incorporated with diamine unless the resultant alkalinity is contraindicated, in which case strengths from 1:250 to 1:1,000 are recommended.

Diamine is not recommended for the routine disinfection of sputum. The intimate mixing required for a sure effect would be entirely impractical. For extreme accidental contamination, such as the spilled content of a specimen bottle, the area should be flooded with concentrated diamine solution (1:200 approximately) containing sodium hydroxide, the disinfectant and the contaminating material should be mixed well and the entire area covered with newspapers or similar material for at least an hour.

### Summary

The disinfectant action of N-dodecyl-1,3-propanediamine (diamine) against highly positive tuberculous sputum was evaluated in several ways. Its activity, particularly in the presence of sodium hydroxide, was high.

Diamine has a broad spectrum antibacterial



# Death Certificate Statement of Occupation: Its Usefulness in Comparing Mortalities

By ROBERT BUECHLEY, M.A., JOHN E. DUNN, Jr., M.D., M.S.P.H.,  
GEORGE LINDEN, M.P.H., and LESTER BRESLOW, M.D., M.P.H.

SEVERAL STUDIES have indicated occupational factors in the occurrence of various chronic diseases. One may cite "chimney sweep's cancer" (1), lung cancer among chromate workers (2), and, more recently, higher rates for coronary heart disease (3) among London bus drivers as compared with bus conductors.

It would seem possible that a comprehensive survey of the frequency of other diseases among all occupations as recorded on death certificates, relating these to the numbers of persons in the occupations enumerated by the census, would provide valuable epidemiological leads—that is, the formulation of hypotheses about the occupational origin of certain diseases.

Such studies would require much detail and accuracy, both in the coding of cause of death and in the coding of occupation. After more than a half century of codification and revision,

the International Statistical Classification of Diseases, Injuries, and Causes of Death has become a workable and consistent tool, with sufficient detail and sufficient accuracy for the purpose. This detail and accuracy has been achieved by querying causes of death that are ill defined or not understood and by a coding system that requires definite and unambiguous statements.

For the other axis of classification, occupation, two major coding systems have been developed in the United States since 1850: The Dictionary of Occupational Titles developed by and for the United States Employment Service and the system developed for the Bureau of the Census by Dr. Alba M. Edwards and others. These systems agree only in broad categories. Furthermore, the occupations reported on death certificates are not routinely coded and thus are not policed for completeness and accuracy as are reported causes of death. This has led to distrust of the accuracy of the occupation entries and to a natural reluctance to use the entries even in the search for epidemiological leads. Only by use, coding, and querying will occupation reporting increase in accuracy.

The only population base available by occupation for computation of rates is that provided by the decennial census enumeration. As we will point out, the definition for occupa-

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## Public Health Nurses in Israel



Hadassah medical organization nurses shown in some of their activities. *Above:* A "home call" to a roving Bedouin family is made to arrange for delivery of an expected child at the modern Beersheba hospital. *Left:* Patients at Safad's restored tuberculosis hospital find the garden a pleasant place for nurse consultation. *Below:* At Kiryat Yovel, a nurse joins the queue of families awaiting inoculations at this project for family-centered treatment.

*Photographs: Hazel Greenwald*



which recommends the rules for death certificate entries, defines the "usual occupation" of an individual as "the job he pursued for the longest part of his working life" (6). This will be called the NOVS definition, and the occupation derived from it will be called "the usual occupation."

5. Finally, on a trial basis, this study uses another method of assigning individuals to occupations. Epidemiological considerations require that the occupation be pursued for a sufficiently long time so that the exposure to the occupational environment can be expected to initiate pathological processes. There is no single answer to "how long is long enough?" but 5 years is offered as an estimate for chronic conditions. Thus, any jobs held for a total of 5 years or more will be called "the exposure occupations." Any one individual, therefore, can, according to this definition, appear in more than one occupational category.

All the occupations and identifying industries worked in for 5 years or more were abstracted from the occupational history onto a 3" x 5" card. This was accomplished by using the 3-digit numerical codes for occupation and industry in the Census Bureau's "Alphabetical Index of Occupations and Industries" (7).

Three classes of occupations were determined from the occupational history. These were (a) the usual occupation, determined by the NOVS definition, (b) the last occupation, determined by the census method, and (c) all the exposure occupations (frequently more than one for each individual), determined by the exposure method. These chosen occupations were also entered on the 3" x 5" card. Industry identification was used only as an aid to coding the occupation.

After the occupation codes had been entered from the occupational history, the occupation and industry from the death certificate were copied verbatim onto the card and then coded according to the 3-digit numerical code. If the code numbers for occupation agreed with respect to all 3 digits, the agreement between occupational history and death certificate entry was considered perfect. Agreement failed, however, when the death certificate and occupational history entries did not agree in respect to all 3 digits.

The number of cases having 3-digit agreement by each of the three methods is shown.

	Cases
All three methods.....	141
Usual occupation and last occupation but not exposure occupation.....	0
Usual occupation and exposure occupation but not last occupation.....	14
Last occupation and exposure occupation but not usual occupation.....	45
Usual occupation only.....	0
Last occupation only.....	26
Exposure occupation only.....	11
No agreement.....	67
Total number of cases.....	304

The percentage agreement for the "usual occupation" method is 51.0

$$\frac{(141+14=155)}{304} \quad \frac{155}{304}$$

For the "last occupation" method, it is 69.7

$$\frac{(141+45+26=212)}{304} \quad \frac{212}{304}$$

For the "exposure" method it is 69.4

$$\frac{(141+45+14+11=211)}{304} \quad \frac{211}{304}$$

The tabulation shows that there is a stable core of 141 persons (46.4 percent) with one and only one occupation determined on their occupational history, no matter which method is used. To this core are added special classes of persons to make up each total. Agreement in terms of usual occupation adds only 5 percent to this core. Last and exposure occupations show almost a 90 percent overlap, that is, the last occupation is usually held for 5 years. The highest percentage agreement is found with the last occupation method, a rather surprising result in view of the plain request for usual occupation on the death certificate.

Our finding indicates that to the people who furnish the information for entry on the death certificate "occupation" seems to mean current or present occupation. This finding appears to be true even if this last occupation is a short-time (less than 5 years) occupation, which tends to increase the number of last occupations reported correctly. The poor agreement of usual occupation apparently results from a tendency to ignore previous occupations if the last occupation has lasted several years.

tional classification on death certification and census enumeration are different. A major epidemiological consideration is the degree of agreement between these two entries in spite of the differences in definition.

### Materials of the Study

The present study was undertaken by the bureau of chronic diseases, California State Health Department, to examine the errors resulting from the present, less than perfect, occupation reporting on death certificates. Though based on a chunk sample, the study offers evidence and conclusions which may be of some use. A recent investigation of lung cancer (4) made available life-long occupational data on certain persons. We took the opportunity to compare these data with death certificate statements of occupation for the same persons.

During 1949, 1950, and 1951, trained occupational analysts took complete occupational histories from 518 lung cancer patients and 518 control patients. The patients, ranging in age from 30 to 80 years, were located in university, county, private, and Federal hospitals. Patients in these hospitals came largely from the middle and working classes of the California population so that professional and managerial classes were under-represented. Since most of the hospitals were in urban areas, the farming population was also poorly represented.

The men in this group were followed through the death indexes of the California Department of Public Health for 1949 through 1952. Four hundred and twenty-three male deaths of all ages (mostly of the lung cancer cases) were found. A copy of the death certificate was obtained for each death and was attached to the occupational history form. Only the 304 males aged 35 to 64 were used for the balance of this study. Persons under 35 are often not "settled" in any occupation, and there are relatively few deaths from chronic disease occurring in this age range. Since persons 65 and over are frequently retired or have taken terminal occupations, only incomplete and less satisfactory population counts by occupation are available from the census enumeration for rate computations in this age group.

### Assigning Occupational Categories

Before working out the problems in comparing death certificates and occupational histories when using closely specified occupations, it is necessary to know what is meant by occupation. Unfortunately, defining occupation is in itself a major problem. Besides the two coding systems noted, several assignment methods or definitions are used in various special fields. There is in addition the complete occupational history of the person concerned. For purposes of clarity, it seems desirable to list and explain the definitions and the five methods this study used for assigning individuals to occupation categories.

1. The entry of occupation on the death certificates often is the raw material in any study of death rates by occupations. Instructions in California and in most other States for entering occupations on death certificates are based on the model certificate proposed by the National Office of Vital Statistics of the Public Health Service. The actual entry, whether or not it is in accordance with these instructions, will be called "the death certificate occupation" or "the death certificate entry."

2. The complete occupational history of the person concerned is a chronological list and description of occupations and lengths of time spent at each. This information has been recorded for the limited group of persons in the present study. For the purposes of this investigation, it will be assumed that the listing is correct although some memory loss, and perhaps bias occurred. This list will be called "the occupational history."

3. The census method of assigning a person to an occupation is given in Bureau of the Census publications (5). It is an operational definition, derived from answers to the question, "What kind of work was he doing . . . at the job he held during the census week? . . . at the last job he held [if he were unemployed]?" In effect, then, the occupational populations derived from the census enumeration, to which the death certificate occupations need be related for the computing rates, are based on last occupation. This method will be called the census method, and the occupation derived from it will be called "the last occupation."

4. The National Office of Vital Statistics,

census code. This method resulted in 72 percent agreement on last occupation as against the 69.7 percent agreement with the 3-digit code. Further improvement in agreement, with loss of occupational precision, results from the use of 1-digit or social class code. This would give 76 percent agreement, as can be calculated from table 1. It does not appear that this increased agreement would be worth the loss of precision. In addition, these broad groupings are more socioeconomic than occupational, and thus exposures peculiar to specific occupations would be lost.

Another means by which agreement could be improved would be to code on environmental exposure, cutting across socioeconomic strata. This method would require groupings on the basis of similar exposure, such as grouping together "farmer" and "farm laborer," widely separated in the census system, or grouping together "aviator, army" and "aviator, commercial," also widely separated. Such a plan would entail development of a completely new coding system on exposure and would be entirely different from the approach with which this study

began. Hence, the 3-digit census codes are used as the basis of agreement or nonagreement for this study.

### Accuracy of Reporting

Only a very few of the many individual occupations are present in sufficient numbers to be treated individually. Grouping these by broad socioeconomic groups, though admittedly not the ideal method, allows some estimates of the variability of reporting accuracy to be made.

Table 1 presents the death certificate occupation, as taken from the death certificate, in comparison with the last occupation, as taken from the occupational history. It attempts to give a concise report of the occupation shifts observed. Although occupations are grouped into the 10 socioeconomic groups used by the Bureau of the Census, it should be reemphasized that percent agreement is by detailed, 3-digit codes. The failures of agreement are of two kinds: upgrading and frank errors.

As evidence of errors of the first kind, the

**Table 2. Comparisons between numbers designated as having a specific 3-digit occupation determined from occupational history, and the 3-digit occupation determined from death certificate entry**

Occupational group	Correct number from occupational history	Number and percent designated on death certificate		Percent of death certificate correct on a 3-digit basis		
		Number	Percent of correct number <sup>1</sup>	Number	Percent as designated on death certificate <sup>2</sup>	Percent of correct number from occupational history <sup>3</sup>
	(a)	(b)	(c)	(d)	(e)	(f)
Professional.....	18	24	133.3	16	66.7	88.9
Farmers.....	6	11	183.4	5	45.5	83.3
Managers.....	17	17	100.0	13	76.5	76.5
Clerks.....	14	14	100.0	10	71.4	71.4
Sales.....	23	22	95.6	16	72.7	69.6
Crafts.....	82	92	112.2	69	75.0	84.1
Operatives.....	47	36	76.6	22	61.1	46.8
Service.....	55	44	80.0	36	81.8	65.5
Farm labor.....	10	4	40.0	3	75.0	30.0
Other labor.....	32	33	103.2	22	66.7	68.8
Total.....	304	297	97.7	212	69.7	69.7

<sup>1</sup> Column  $b \div a \times 100$ .

<sup>2</sup> Column  $d \div \text{column } b \times 100$ .

<sup>3</sup> Column  $d \div \text{column } a \times 100$ .

<sup>4</sup> Includes 7 for whom no occupation was designated.

**Table 1. Degree of 3-digit agreement between death certificate statement of occupation and last occupation, in broad socioeconomic groups**

3-digit occupations from death certificates		Socioeconomic groupings of 3-digit last occupations from occupational histories									
Socioeconomic group	Number of reported cases	Professional	Farmers and farm managers	Proprietors, managers, and officials	Clerks	Sales	Crafts	Operatives	Service	Farm labor	Labor, excluding farm and mine
Professional	24										
Agree	16	16									
Disagree	8	2		1	1		3	1			
Farmers and farm managers	11										
Agree	5		5								
Disagree	6			1				2		2	1
Proprietors, managers, and officials	17										
Agree	13			13							
Disagree	4					3			1		
Clerks	14										
Agree	10				10						
Disagree	4					2			2		
Sales	22										
Agree	16					16					
Disagree	6		1	1	1		1	1	1		
Crafts	92										
Agree	69						69				
Disagree	23					1	5	8	3	1	5
Operatives	36										
Agree	22							22			
Disagree	14			1	1		4	4		2	2
Service	44										
Agree	36								36		
Disagree	8								7	1	
Farm labor	4										
Agree	3									3	
Disagree	1							1			
Labor, excluding farm and mine	33										
Agree	22										22
Disagree	11							5	4	1	1
Unknown and not in labor force	7										
Agree	0										
Disagree	7				1	1		3	1		1
Total	304	18	6	17	14	23	82	47	55	10	32
Agree	212	16	5	13	10	16	69	22	36	3	22
Disagree	92	2	1	4	4	7	13	25	19	7	10

### Choosing the Method of Assignment

As indicated previously, the populations by occupation provided by census enumeration are based on last occupation. The validity of mortality rates by occupation, which are based on entries of occupation on death certificates on one hand and census enumerations on the other, is dependent on the degree to which death certificate entries represent last occupation. Fortunately for our purposes here, although in dis-

regard of instructions, death certificate entries are most apt to be last occupation and not usual or some other prior occupation. The remainder of our presentation, therefore, will be concerned only with the agreement between last occupation revealed by occupational history and that entered on the individual's corresponding death certificate.

We attempted to group occupations according to a 2-digit code rather than the 3-digit

group of lung cancer patients and controls and had obtained their occupational histories. To study the limitations inherent in the use of death certificates for occupational mortality studies, the occupation reported on the death certificate was later compared with the occupation reported in the interview. The study is based on a chunk sample, but it indicates the kind of results obtainable.

From comprehensive occupational histories, mostly of the lung cancer patients, 304 deceased men aged 35-64 were assigned to the 3-digit occupation codes used by the Bureau of the Census. A similar assignment of occupation codes was made for the occupations reported on the death certificates. Occupation was in agreement when the assigned 3-digit codes were identical. Out of a multiplicity of possible rules for assignment, three were applied to the occupational histories. These rules and the percentage agreements they generated are as follows:

"Usual occupation" method, the National Office of Vital Statistics rule—51.9 percent agreement.

"Last occupation" method, Bureau of the Census rule—69.7 percent agreement.

"Five-year exposure occupation" method, our own rule—69.4 percent agreement.

Despite a phrase on the death certificate defining usual occupation, the death certificate entries best represent last occupation. Because of this situation, because death rates must be computed by using death certificate populations for the numerator and census populations for the denominator, and because the denominator occupations are defined by the census rule for last occupation, we used the last occupation rule for the balance of the study.

By grouping occupations into 10 broad groups, though retaining 3-digit agreement, we obtained some idea of the variability of misreporting. Since it cannot be assumed that this variability is random, the specific net misreporting for each group must be used with caution. By considering the effects of positive association between a cause of death and an occupation, it seems evident that strong positive associations will show themselves despite considerable misreporting.

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number of entries above and to the right of the diagonal in table 1 is larger than the number below and to the left. There is movement upward into professionals, managers, and craftsmen from operative and service occupations. Death certificates placed 45 persons in "higher" occupations, socioeconomically, than warranted, and placed only 21 in "lower" occupations.

Frank errors occur throughout table 1 in a somewhat random manner. They are also responsible for the anomaly of persons coded to the correct socioeconomic group but not to the correct occupation within the group, for example, an actor reported as an aviator or a painter reported as a carpenter. While social class is correct for these occupations, environmental exposures may be completely incorrect. Another feature is the variability between groups in proportion of agreement. This is further presented in table 2, which is a summary and extension of part of table 1.

Several comparisons between persons known from occupational history to have specific occupations and those designated with these specific occupations on death certificates are shown in table 2. Columns *a*, *b*, and *c* of the table indicate the order of magnitude of the error in the number of deaths attributed to an occupation compared with what this number should be. It is of some interest to know the numerical error in the numerator of a rate even though a portion of this number may include the wrong persons. The greatest error is for farmers and farm laborers, with over 80 percent excess in the former and 60 percent deficiency in the latter. The obvious explanation would seem to be the upgrading of farm laborers to farmers on death certification. This is partially true but, as can be seen in table 1, misreporting out of and into these categories is not quite that simple and direct. As might be expected, the professional category of occupations has the next highest excess, which is largely a result of upgrading on death certificates, as can be seen in table 1. The other occupational categories are considerably closer to their correct number, with only operatives and service workers deviating as much as 20-25 percent. The actual rates of mortality from death certificates for such categories as managers, clerks, salesper-

sons, and craftsmen will not be severely biased because of excessive or inadequate numbers of deaths attributed to the specific occupations in these categories.

Columns *d* and *e* in table 2 show that on the average about 70 percent of those persons designated on death certificates as having a specific occupation will actually have had the occupation. The range is from 45.5 percent for farmers to 81.8 percent for service workers. Column *f* of table 2 gives the percentage of those persons who have a specific occupation on their occupation history that is identically designated on their death certificates.

The essential proportions for anticipating and interpreting data from the use of occupation on death certificates in the search for abnormal risk of fatal disease are contained in columns *e* and *f* of table 2. Column *e* indicates the degree and direction of bias for mortality rates where, owing to misreporting, the percentage deviation from 100 is unrelated to occupation. For example, occupations in the professional category would be one-third excessive, operatives would be 23 percent deficient, and managers and clerks would be approximately correct. However, in the case of a specific occupation carrying an increased risk of disease, the excess deaths would be retained in the specific occupation on death certificates according to the proportions given in column *f*.

### Conclusion and Summary

At the present it must be admitted that searching for increased risk of specific causes of mortality in specific occupations through death certificate occupational entries is a rather crude and somewhat insensitive method. However, those who are interested have an excellent chance of recognizing increased risks of the order of several fold by this approach. It is also likely that a significant increased risk, when found, will understate the true risk.

Analysis of death rates by cause and by detailed occupation may reveal useful relationships. Cause of death is fairly accurately reported while occupation, not at present being routinely coded or "policed," is less accurate. The bureau of chronic diseases of the California State Department of Health had interviewed a



tration medium at 0, 2, 4, and 6 hours. Separate tubes were employed for the penicillinase addition. Therefore, five tubes were used for each penicillin G concentration. The fifth tube was a control containing no penicillinase. The concentration of penicillinase used was sufficient to inhibit all concentrations of penicillin G used in this experiment and did not inhibit the growth of the organism when penicillin was absent or present.

## Results and Discussion

Penicillin G inhibited the growth of *H. ducreyi* strain CH1A, at concentrations over 0.1 unit per milliliter of agar. Gram stains of cells of the 0.1-unit plates showed cells that were swollen and elongated to several times their normal size, which indicates that this concentration constitutes a sublethal dose (8). Growth was not inhibited, and subcultures of these organisms on nutrient blood agar without the drug resulted in normal appearing *H. ducreyi*. These results are shown in the following tabulation:

Penicillin G (units/ml. agar)	Type of cells
0-----	Normal chains.
.001-----	Do.
.01-----	Do.
.1-----	Swollen and elongated.
.2-----	No growth.
.3 to 20.0-----	Do.

Efforts to transfer normal and elongated cells to gradually increased amounts of the drug resulted in no detectable resistant organisms.

The results as shown in the following table indicate that inhibition is a relationship of concentration of penicillin G and the length of time *H. ducreyi* is in contact with the drug. Consequently, 0.1 unit of penicillin G per milliliter of casitone-saline medium did not inhibit growth after 24 hours; 0.2 units of penicillin G per milliliter of medium inhibited growth after 6 hours' contact; 0.3 units of penicillin G per milliliter of medium inhibited growth after 4 hours' contact; and concentrations of penicillin G of 0.4 units or more per milliliter of medium inhibited growth in less than 2 hours' contact.

In the liquid medium no swollen and elongated cells were observed at any concentration of the drug used.

## Time at which concentrations of penicillin G inhibit growth of *Hemophilus ducreyi*, strain CH1A, grown in casitone-saline medium for 24 hours

Penicillin G (units/ml. medium)	Hours at which penicillinase was added				No peni- cillinase added
	0	2	4	6	
0-----	+	+	+	+	+
.1-----	+	+	+	+	+
.2-----	+	+	+	+	—
.3-----	+	+	+	—	—
.4-----	+	—	—	—	—
.5-----	+	—	—	—	—
.6-----	+	—	—	—	—
.7-----	+	—	—	—	—
.8-----	+	—	—	—	—
.9-----	+	—	—	—	—
1.0-----	+	—	—	—	—

+ indicates growth and no inhibition.

— indicates inhibition of growth.

All tubes were incubated an additional 24 hours and were read, with no changes in the results. Wetherbee and co-workers (2) cultured *H. ducreyi* in tryptose phosphate serum broth with various concentrations of penicillin G and subcultured the organism 24 and 48 hours on chocolate tryptose agar plates. They found that penicillin G inhibited at 0.1 to 0.5 units per milliliter at 24 hours but that there was less inhibition at 48 hours. This suggested to Wetherbee that penicillin prolongs the lag phase but is not significantly bacteriostatic. While Wetherbee and his associates did not demonstrate any significant bacteriostatic effect of penicillin G upon *H. ducreyi*, our results indicate actual bacteriostatic and bactericidal effects based upon concentration of the penicillin G and the length of time the drug had to act upon the organisms. In our laboratory, avirulent strains of *H. ducreyi* showed different sensitivities to penicillin G and other antibiotics than did *H. ducreyi*, strain CH1A, or other virulent strains. Therefore, it seems probable that the strains Wetherbee and co-workers used were avirulent.

Eagle (9) states that penicillin G is inactivated by serum in vitro. Our experiments showed that 5-percent rabbit serum did not inhibit the effect of penicillin G upon the organisms. This, of course, may be more apparent

# Effects of Penicillin G In Vitro On *Hemophilus ducreyi*

By SOLOMON SINGER, M.S.,  
and WILBUR E. DEACON, Ph.D.

DURING the course of experiments at the Venereal Disease Research Laboratory on the treatment and prophylaxis of chancroid induced in human volunteers (1) and in animals, it was observed that therapy with oral penicillin G (Bicillin) did not aid recovery.

Previous reports have indicated *Hemophilus ducreyi* to be sensitive to penicillin in vitro (2-4) while in vivo experiments have demonstrated equivocal findings.

Deacon and associates (1), trying to confirm Willcox's theory that penicillin might be of value if given in such a manner as to produce and maintain high serum concentrations (5), found that penicillin G administered orally in five chancroid infected volunteers produced mean serum levels of only 0.025 penicillin G units per milliliter of serum. This concentration was not effective as a prophylactic agent for *H. ducreyi* infections. Treatment with orally administered penicillin V in five volunteers, however, resulted in a mean serum level of 0.232 penicillin G units per milliliter of serum, and lesions were definitely controlled during this treatment. Furthermore, if penicillin V was administered orally prior to inoculation with *H. ducreyi*, levels of penicillin G units per milliliter of serum reached a mean level of 0.492, and the volunteers either failed to develop lesions or developed very few lesions.

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Mr. Singer is a bacteriologist and Dr. Deacon is chief, Microbiology Research, at the Public Health Service Venereal Disease Research Laboratory, Chamblee, Ga. Their work was supported in part by the Medical Research and Development Board, Office of the Surgeon General, U. S. Department of the Army.

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In an effort to correlate Deacon's findings with in vitro results, the present study was undertaken. Our purpose was to determine the concentrations at which penicillin G inhibited the growth of *H. ducreyi* and the length of time at which concentrations of penicillin G inhibited growth.

## Materials and Methods

Inoculum for all experiments was prepared by inoculating 5 ml. of casitone-saline medium (6) (1 percent Difco bacto casitone, 0.85 percent NaCl, plus 5 percent sterile rabbit serum), contained in 150 mm. x 20 mm. screw-cap test tubes (Kimble No. 45066), with a loopful of 24-hour *H. ducreyi*, strain CH1A (7), which is representative of virulent strains in our laboratory, grown in the same medium. Incubation of these cultures was at 34° C. for 16 to 24 hours. At the end of the incubation period, cultures were checked for purity by means of a Gram stain and subculture upon nutrient blood agar (7) (Difco nutrient agar 1.5 percent plus 5 percent defibrinated rabbit blood) plates. These plates were incubated at 34° C. in candle jars for 48 hours. The culture used as the inoculum was the same as used by Deacon and co-workers (1), had been checked previously for its ability to produce typical lesions in volunteers (1), was of known pathogenicity, and during manipulation did not lose pathogenicity.

To determine the concentration at which penicillin G inhibits the growth of *H. ducreyi*, nutrient blood agar plates containing concentrations of penicillin G from 0 to 20 units per milliliter of agar were inoculated with 0.5 ml. inoculum and the surface of the agar spread with sterile bent glass rods. These plates were incubated at 34° C. in candle jars for 48 hours. Colonies were observed, and Gram stains were made in order to observe morphology.

It was also desired to determine the length of time at which concentrations of penicillin G inhibited growth. Screw-capped test tubes, 150 mm. x 20 mm., with 10 ml. of casitone-saline medium and containing graded amounts of penicillin G were inoculated with a loopful of the *H. ducreyi* culture. One milliliter of 1,000 units of Difco bacto-penase (penicillinase) was added to each tube of each penicillin G concen-

# Disability in Butler County, Pennsylvania

By SAXON GRAHAM, Ph.D.

**T**HE EXTENT of disability in a large population, conceived as individual inability to behave adequately in consequence of disease or injury, has received relatively little investigation.

A definition of adequate behavior should perhaps be a philosophical one. But for the purpose of measurement, we may discern forms of behavior which are attributable to a physiological handicap. For example, disease or injury may contribute to breakdowns in the interpersonal relations between the individual and members of his family. It may prevent him from carrying on his usual occupation. It may force him into restrictions of diet. It may result in motor disabilities, which are the forms with which this paper is concerned. These include the inability of the individual to feed himself, to dress and groom himself, to walk without help, and to climb or descend stairs, and the necessity of being confined to the house or bed or of having to use a wheelchair or a crutch or cane to walk.

Such disabilities present a much more tangible problem to the community than illness per se. Illnesses are important to society mainly because of their potential for causing either death or disability. It is the death or disability resulting from illness or injury, rather than

the illness itself, which creates the burden of expense and the loss of productivity.

In 1954, we attempted to assess motor disability, as we have described it, in Butler County, Pa. We investigated the extent and duration of motor disability in the population and the frequency of various kinds of disability. Also, we attempted to associate a specific disease or injury with each disability.

## Method of Inquiry

The data for this inquiry were obtained as part of comprehensive health studies in Butler County. They are based on a probability sample of 3,403 residents. The sample allowed for geographic stratification and the proportionate representation of urban, rural place, and open country population.

Butler County is directly north of Allegheny County, which includes Pittsburgh. Of its total population of about 103,000, 28.1 percent live in cities; 19.4 percent, in rural places; and the remaining 52.5 percent, in open country. Ethnically, the population is relatively homogeneous, an American mixture of people with European ancestry. There is a smaller proportion of foreign-born residents than would be expected on the basis of national statistics. Housing and sanitation present few, if any, serious trouble spots.

Interviewing, editing, and coding were carried on during the summer of 1954. Interviewing was conducted by women. They spoke with only one member of each household, who was requested to report on the conditions of all other members. Questions were asked regarding chronic disease, physical impairments, acute

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*Dr. Graham, assistant professor of medical sociology, department of biostatistics, University of Pittsburgh, is director of the Butler County health studies. These studies were initiated to examine the impact of the newly established county health department on the population of the county.*

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than real. Some of the penicillin G may have been bound by some component of the serum, but the bactericidal effect is there, nevertheless.

Consequently, the sensitivity of this organism to penicillin G is an expression of the amounts which must be present in the medium in order to effect a binding with some cell constituent or constituents. Eagle and co-workers (10) interpret the binding of penicillin by bacteria to be determined by a single essential component, which is functionally inactivated by that combination which is normally present in significant excess. Schepartz and Johnson (11) propose that "binding occurs by cleavage of the beta lactam ring of penicillin and combination of the carbonyl or imino group of that ring with the binding component."

Our *in vitro* results can be compared with the *in vivo* results of Deacon and co-workers (1) in that, if the serum level of penicillin G is about 0.2 units per milliliter, that concentration should be sufficient to inhibit growth of *H. ducreyi*, strain CH1A, less than 24 hours after the patient's blood has attained this penicillin level. More immediate response would be expected if 0.3 or 0.4 units of penicillin G per milliliter of blood could be attained. Eagle and associates (12) state that the therapeutic action of penicillin is in a large part measured by the aggregate time for which it remains at effective levels at the focus of infection, that these effective levels *in vivo* are of the same order of magnitude as those effective *in vitro*, and that the effective penicillin time in the serum is usually a reasonable approximation of the penicillin time in tissue fluids.

While penicillin G can inhibit the growth of *H. ducreyi* *in vitro*, Deacon and co-workers (1) have shown that the serum penicillin G level does not attain the necessary concentration. Penicillin V, however, by increasing the serum penicillin G level, shows some usefulness in treatment of chancroid.

### Summary

Penicillin G is bactericidal for *Hemophilus ducreyi*, strain CH1A, at concentrations over 0.1 unit per milliliter of medium. Inhibition of growth is dependent upon the concentration of the drug and the length of time at which the organism is in contact with the penicillin G.

A blood level of 0.3 or 0.4 units of penicillin G per milliliter should inhibit the growth of virulent *H. ducreyi* in 2 to 6 hours, and a level of 0.2 units of penicillin G per milliliter should inhibit the growth of this organism in less than 24 hours.

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uals over many years, not to mention the fact that the community has had to support some of them, adds up to an important economic handicap.

The age and sex distribution of the 54 persons having disabilities, shown in figure 1, indicates that as age increases the proportion of persons disabled increases in rapid fashion, particularly among females. The rate of 2.6 per 1,000 for females under 25 years of age was about the same as the rate for males in this age group. However, for persons 65 and over, the female rate had increased to about 140 per 1,000, whereas the male rate had increased to only about 50 per 1,000. In every age group except the under-25-years one, more women than men were disabled. We must caution, of course, that here we are dealing with characteristics which appear relatively infrequently in the population. Estimates for prevalence by sex in the younger age groups have large relative standard deviations. However, estimates for the older age groups are more reliable, and the consistency of findings relative to sex in all age groups indicates a higher prevalence among females.

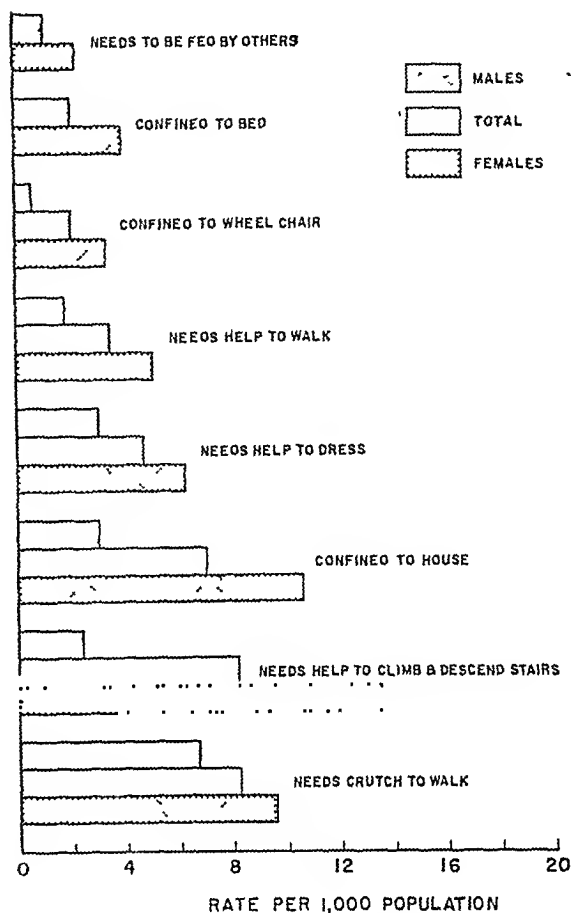
### Types of Disability

Figure 2 shows the prevalence of various types of motor disability. The least frequent condition was having to be fed by another person. No males were in this category. The rate for females was 2.3 per 1,000; for all persons, it was 1.2 per 1,000.

Slightly higher was the prevalence of having to use a wheel chair; 2.1 persons per 1,000 were so incapacitated. Here again, most of the cases were found among females. Their rate of 3.4 per 1,000 was 5 times the rate for males. The rate for being confined to bed was also 2.1, and this disability existed exclusively among females.

Rates for the other disabilities increased from 3.5 for needing help to walk, to 4.7 for needing aid to dress, to 7.1 for being confined to the house, to 8.2 for having to use a crutch or cane to walk and for needing assistance in climbing or descending stairs. For every disability, the rate was higher for females than for males. The greatest difference between males and females was found for the inability to climb or

Figure 2. Prevalence of various motor disabilities, by sex, Butler County, Pa.



descend stairs without help. Here the rate for males was 2.5 per 1,000, and that for females, 13.6. The smallest differences between the sexes were found for the inability to dress without help and the need to use a crutch or cane to walk. For the former, the male rate was 3.1 and the female rate was 6.2; for the latter, the male rate was 6.7 and the female rate was 9.6. Again, these estimates have high relative standard deviations, and the magnitude of the rates should be interpreted with caution.

### Causes of Disability

As shown in figure 3, conditions of the skin, bones, and organs of movement were mentioned as contributing to 30.2 percent of the disabilities. These conditions included pemphigus and especially arthritis. Injuries resulting from accidents were next most important, accounting

disorders, maternal and child health, nutrition, disabilities, sanitation, and sociological characteristics relevant to health. Specific queries were put as to whether individuals in the households in the sample had any of the motor disabilities mentioned above. When a positive answer was given, questions were asked as to the medical condition responsible for the disabilities.

Caution must be observed in the interpretation of the findings of this survey. It was impossible, for example, to determine the accuracy of statements interviewees made as to the medical reasons for the disabilities. Also, since only one member of the household was interviewed, there was no way of knowing for certain the actual status of anyone except that member. Nevertheless, comparison of the survey findings with those of the United States census of 1950 reveal close agreement on such nonmedical factors as the total number of persons in the county; the age and sex distributions of the population; the proportions of residents in open country, rural place, and urban areas; and the proportions having various amounts of education.

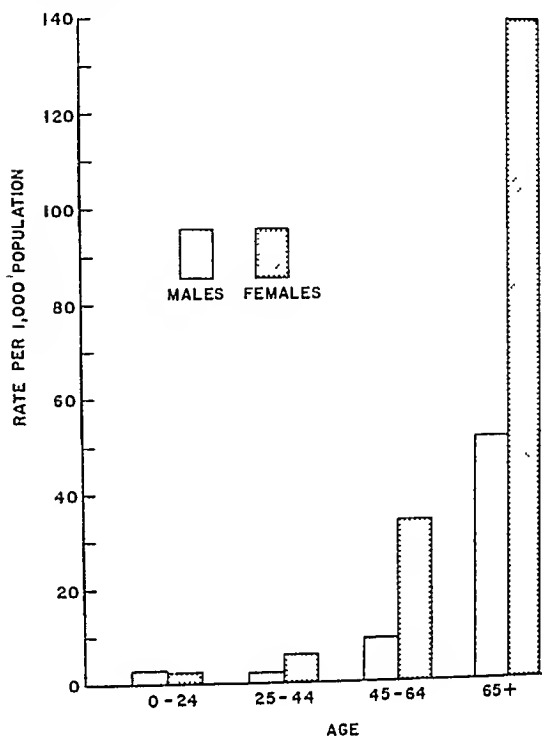
Estimated relative sampling errors for the more important statistics obtained in the health studies were as follows: a range of 3.7 to 7.7 percent for estimates of the numbers of persons in different age groups, 5.2 percent for the estimate of the number hospitalized in the year preceding the survey, and 13.2 percent for the estimate of the number of persons disabled.

### Prevalence of Disability

Because of the lack of comparable data on disability in other areas, it is difficult to assess the situation in Butler County. Nevertheless, the number of people disabled, the proportion of households affected, and the duration of the disabilities found indicate that the problem is substantial.

Of the 3,403 persons in the sample, 54 had disabilities of the kinds investigated in the survey, a rate of 15.9 disabled persons per 1,000 population. These 54 people were afflicted with a total of 128 disabilities. The rate for persons with but one disability was 6.2 per 1,000 population; for those with 2 or more disabilities, it was

Figure 1. Age and sex distribution of persons having one or more motor disabilities, Butler County, Pa.



9.7. Of the 54 disabled persons, 61.1 percent had more than one disability. In sum, the prevalence rate for the disabilities examined in this study was 37.6 per 1,000 population.

The effects of disability, of course, are not confined to the individual who has it. They influence the whole family. Results of this study showed that a substantial proportion of the households in the county, 5.4 percent, had disabled persons among their members. One disabled person was found in 5.1 percent of the households, and 2 or more in 0.3 percent.

Another method of measuring disability is by its duration. If we sum the number of years each disabled person was unable to function optimally, we find that at the time of the survey 141.4 man-years per 1,000 population had been lost because of disability. About 1 person per 1,000 had been disabled 30 to 36 years. Almost 2 per 1,000 had been disabled 20 to 25 years, and about the same number had been disabled 10 to 15 years. The largest number, 6.2 per 1,000, had been disabled less than 5 years. The loss of the services of these disabled individ-

Comparison of the prevalence and distribution of antibodies to *Toxoplasma gondii* in an urban and a rural population suggests that factors responsible for transmission of human toxoplasmosis are common to both groups.

# Distribution of *Toxoplasma* Antibodies in Comparable Urban and Rural Groups

By COLVIN L. GIBSON, Ph.D.

ONE of the major gaps in our knowledge of human toxoplasmosis is the means by which man comes into contact with, and becomes infected by, the causative agent, *Toxoplasma gondii*. Numerous studies in various parts of the world have made it clear that serum antibodies to *T. gondii* are widely prevalent in humans, suggesting that infection is relatively common although frequently inapparent, but little information has been published regarding the environmental factors which may contribute to the spread of this infection.

A recent study by the author and his colleagues of a rural Negro population near Memphis, Tenn., gave a clear picture of the distribution of *Toxoplasma* antibodies in that particular group (1). It showed that the prevalence of antibodies is about the same in both sexes; that the titers fall into a bimodal distribution suggestive of a nonspecific reaction at the lowest titers; that the chance of finding

antibodies increases with age; and that young people tend to have higher titers than older people.

That study, however, did not allow us to pinpoint any of the factors that might be working to produce such a distribution of titers. Nor did it permit us fruitfully to compare that population with any other group. The present study was therefore undertaken to attack the question of environmental factors in the transmission of toxoplasmosis by comparing the antibody status of the rural Negro population with that of a comparable urban group.

## Methods

Figure 1 shows the geographic region in which this study was made. The urban sample consisted of 627 serums taken at random from the students of a large junior-senior high school in the city of Memphis. The students, all Negroes, ranged in age from 11 through 19 years. The rural sample consisted of 445 serums from persons in the same age group, also Negroes, taken at random throughout Fayette County, but chiefly from the area south of the Wolf River, which is shown shaded on the map.

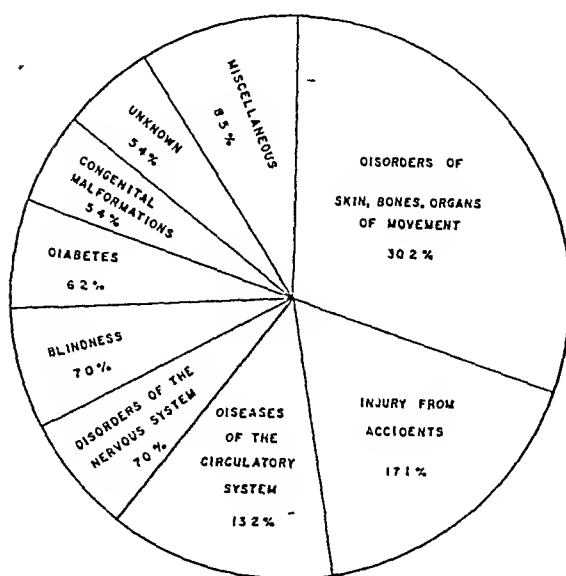
Most of the serums from the rural population which we tested in the present study were included in the larger rural sample, represent-

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**Figure 3. Medical conditions contributing to motor disabilities, Butler County, Pa.**



for 17.1 percent of the disabilities. A large proportion, 13.2 percent, were attributed to conditions involving the circulatory system, particularly heart disease. Seven percent were caused by diseases of the nervous system, and the same percentage, by blindness. Diabetes was responsible for 6.2 percent of the disabilities, and congenital malformations, for 5.4 percent.

Twenty-four different types of medical conditions were cited as contributing to the motor disabilities. These conditions were mentioned as contributing to 128 disabilities in 54 disabled persons. Thus, a given medical problem in an individual caused, on the average, more than 2 motor disabilities. Four persons mentioned heart disease as causing them a total of 10 different motor disabilities. Arthritis was cited by 14 persons as contributing to a total of 26 disabling afflictions.

### Summary and Conclusions

As public health scientists increasingly concern themselves with social well-being in addition to physical health, their interests will be focused more and more on problems such as the problem of disability. Disease in itself is a problem, but it is a liability to society mainly

when it causes a disability of one sort or another. When disability is defined as the inability of the individual to function adequately as a member of society, it immediately becomes a matter of first concern to public health.

The study in Butler County, Pa., based on a probability sample of 3,403 residents, gives some idea of the extent of motor disability. It was found that 15.9 persons per 1,000 population were afflicted and that more than 5 percent of the households had at least one disabled member. Disability was found more frequently among women than among men and more frequently among persons over 60 years of age than among younger persons. The disabilities of highest prevalence were the need for help in climbing or descending stairs and the need to use a crutch or cane to walk, each with a rate of 8.2 per 1,000. Next came being confined to the house (7.1), needing help to dress (4.7), requiring aid in walking (3.5), having to use a wheelchair (2.1), and being confined to bed (2.1). Having to be fed by another person was the least prevalent of the disabilities studied.

Among the medical causes of these disabilities, arthritis, injuries, and heart disease were prominent. Disabilities were typically of long duration, with one-third of the disabled population functioning less than optimally for from 10 to 36 years prior to the survey. The rate of man-years lost from optimal functioning because of disability was 141.4 per 1,000 population.

Undoubtedly, these figures underestimate the prevalence of disability, for they include only the disabled persons present in the households at the time of the interview. They do not include individuals who are disabled and living in institutions. For this and other reasons, caution must be exercised in interpreting the findings on disability in Butler County.

The Butler County study constituted an exploration of a subject about which we have little quantitative information. Apparently, the problem of disability is not negligible. Before we can assess it properly, we require better data on its magnitude, on the social and physiological factors which figure in its etiology, and on its costs to society in loss of production power and long-term expenditures for medical care.



# Distribution of serums positive for *Toxoplasma* antibodies by titer for urban and rural populations in Tennessee

Habitat and age in years	Number of serums tested	Number of serums positive							Percent of serums positive (all titers)
		Undiluted	1:4	1:16	1:64	1:256	1:1,024	All titers	
<i>Urban</i>									
11.....	13	0	0	0	0	0	0	0	0.0
12.....	70	6	1	6	3	0	0	16	22.8± 5.0
13.....	129	5	1	10	11	1	0	28	21.7± 3.7
14.....	101	4	1	8	6	2	0	21	20.8± 4.1
15.....	116	8	2	7	6	0	1	24	20.7± 3.8
16.....	102	4	0	7	5	1	1	18	17.6± 3.8
17.....	62	3	3	2	2	2	0	12	19.4± 5.0
18.....	25	0	1	2	1	3	0	7	28.0± 9.0
19.....	9	0	0	1	1	0	0	2	22.2± 13.9
Total.....	627	30	9	43	35	9	2	128	20.4± 1.6
Males.....	298	7	5	23	19	6	0	60	20.1± 2.3
Females.....	329	23	4	20	16	3	2	68	20.7± 2.2
<i>Rural</i>									
11.....	70	2	1	1	6	1	1	12	17.2± 4.5
12.....	62	3	3	3	4	2	0	15	24.2± 5.4
13.....	72	6	0	2	3	4	1	16	22.2± 4.9
14.....	63	3	2	5	2	1	1	14	22.2± 5.2
15.....	57	2	0	4	1	0	0	7	12.6± 4.4
16.....	42	1	0	1	1	2	0	5	11.9± 5.0
17.....	39	0	0	2	1	2	2	7	17.9± 6.1
18.....	33	0	0	3	4	1	0	8	24.2± 7.5
19.....	7	0	0	0	0	0	0	0	0.0
Total.....	445	17	6	21	22	13	5	84	18.9± 1.9
Males.....	231	6	4	12	14	7	3	46	19.9± 2.6
Females.....	214	11	2	9	8	6	2	38	17.8± 2.6

percent) had undiluted positive titers as contrasted with 23 of the 329 females (7.0 percent).

The difference between these rates is highly significant statistically ( $P = 0.005$ ), but at present we cannot offer an explanation for this difference. A similar trend can be detected in the rural sample, in which 6 out of 231 males (2.6 percent) and 11 out of 214 females (5.1 percent) had undiluted positive serums, but the difference here is not statistically significant ( $P = 0.16$ ).

Both the urban and the rural populations showed a distinct bimodal distribution of titers, with an unexpectedly large number of serums positive at the undiluted level. This distribution is illustrated graphically for all ages combined in figure 3. The large number of undiluted positives is consistent with the hypothesis of a nonspecific reaction, but we do not know what significance, if any, these low titers have in the epidemiology of toxoplasmosis.

The upper modal titer for the urban popula-

tion falls at a dilution of 1:16, while the upper modal titer for the rural group is 1:64. This shift cannot be related to age, since both groups include persons from 11 through 19 years, and analysis of the individual age samples does not reveal any trend in this direction. To determine whether the shift of modal titer actually is significant, we tested the data by the chi-square method. For this purpose, the positive serums were divided into two groups, those positive at a dilution of 1:16 or lower and those positive at a dilution of 1:64 or higher. The probability value derived from this calculation is slightly more than 0.05, suggesting that the shift in modal titer between the urban and the rural group may not be significant.

An entirely different picture is obtained, however, when we group together those serums having titers of 1:256 or higher as opposed to those positive at a dilution of 1:64 or lower. With this grouping, the probability value is only 0.009, indicating that the difference between the

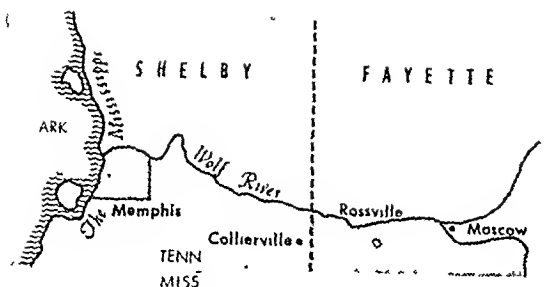


Figure 1. Location of urban and rural populations from which serums were collected. The urban sample was composed of Memphis residents; the rural sample, of Fayette County residents, chiefly those in the area south of the Wolf River.

ing 987 persons of all ages, analyzed in a previous report (1). In order to relate the present study of a restricted age group to the overall prevalence in rural Fayette County, we show in figure 2 the prevalence rates for all ages, as previously reported. Rates reported for other parts of the world by various investigators are also included for purposes of comparison. In general, the antibody prevalence in rural Fayette County was greater than the level found in England (2) but less than that found in the Netherlands (3), in Germany (4), and in Austria (5). In the present report we shall be concerned only with the small portion of the curve from 11 through 19 years of age.

All the serums in both our samples were tested by the Sabin-Feldman dye test. The technique originally described by these investigators, including inactivation at 56° C. for 30 minutes, was used (6). Serums were tested undiluted and at progressive fourfold dilutions (1:4, 1:16, 1:64, and so forth) until the end point was reached. Frequent comparative tests on unknown serums by our laboratory and several other research laboratories in the United States have always shown good agreement, a fact which lends confidence to our results.

## Results

The results obtained by the dye test for each of the sample populations are summarized in the table.

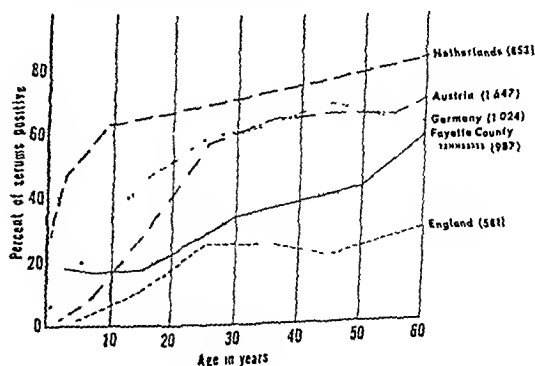
The prevalence of positive serums was  $20.1 \pm 2.3$  percent for urban males and  $20.7 \pm 2.2$  percent for urban females. Comparable rates for the rural group were  $19.9 \pm 2.6$  percent for males and  $17.8 \pm 2.6$  percent for females. Statistical analysis indicated that the slight differences in overall prevalence of positive serums between males and females in each population were not significant. (*P* values were 0.85 and 0.58 for the urban and rural groups, respectively.) Even when an analysis was made of each 1-year age group, no significant difference between the sexes could be detected. The greatest divergence occurred in the 11-year-old rural group, in which 24.3 percent of 37 males and 9.1 percent of 33 females were positive. Statistical analysis of these data using the formula

$$\sigma_a = \sqrt{(p \times q)/N_1 + (p \times q)/N_2}$$

gave a probability value of 0.09, which indicates that the observed difference between the sexes in this group probably is not significant. Since we failed to find a significant difference between males and females with respect to the prevalence of positive titers, data for the sexes were combined in all later calculations unless otherwise indicated.

One possible exception should be noted to the conclusion that there is no significant difference between males and females with regard to the prevalence of positive serums. For serums positive at the undiluted level, there was a highly suggestive difference between the sexes in the urban sample. Only 7 of 298 males (2.3

Figure 2. Prevalence of *Toxoplasma* antibodies by age, as reported for various parts of the world (1-5). Figures in parentheses show number of serums tested.



positive serums; that, although there is a difference in the upper modal titer between the two groups, it probably is not significant; that the rural group shows an unexplained tendency to produce titers of 1:256 or higher; and that the prevalence of positive titers is essentially similar in the urban and rural populations, both when all titers are considered together and when only titers of 1:16 or higher are considered.

The similarity between the urban and rural populations suggests that the factors responsible for transmission of human toxoplasmosis are common to both environments rather than being peculiar to one or the other.

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## Dental Manpower Resources

The demand for dental care is expected to increase more rapidly than the number of practicing dentists and dental hygienists in 11 western States.

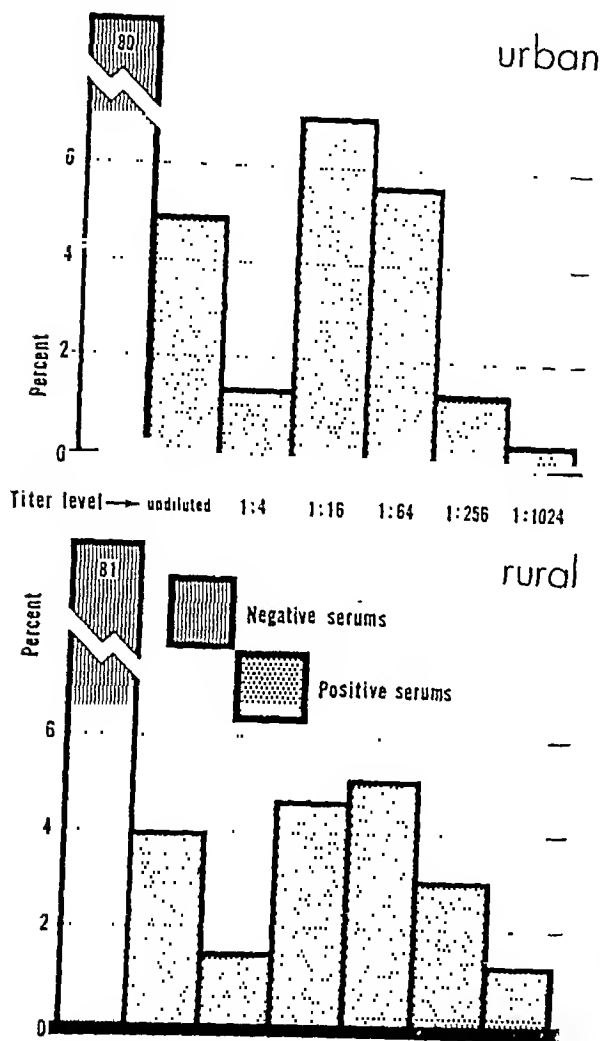
Of the 95,000 dentists who are expected to be practicing in the United States by 1975, about 16,000 will be located in the west. This would be an increase of 4,000 over the number practicing in the region during 1955, but still it would be 5,000 short of the number needed to maintain supply at the current level. It will be roughly 20,000 under the number required to meet the higher per capita demands for care which are expected at the end of the 20-year period.

Currently, western schools are graduating only 400 dentists annually. To meet demand, they must graduate an average of 1,600 a year between 1960 and 1975.

Dental hygienists must also be trained in greater numbers. Additional training programs are needed in junior and 4-year colleges. The west needs approximately 800 dental hygiene graduates a year, compared with the fewer than 70 now being supplied.

These requirements are stated in "Dental Manpower Requirements in the West," a survey covering Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. The survey was undertaken at the request of the Western Interstate Commission for Higher Education and was conducted by the Division of Dental Resources, Public Health Service, in cooperation with the American Dental Association and the W. K. Kellogg Foundation.

Figure 3. Distribution of all serums tested, by titer, showing bimodality and shift of upper modal titer.



two populations is of considerable significance. Thus the rural population shows a strong tendency to produce high titers, but we do not know what the significance or cause of this tendency may be.

For both sexes and all ages combined,  $20.4 \pm 1.6$  percent of the 627 serums tested from the urban group were positive (all titers), as compared with  $18.9 \pm 1.9$  percent of the 445 serums from the rural group. Somewhat lower rates are obtained when only titers of 1:16 or higher are considered positive, on the assumption that the lower titers may represent nonspecific reactions in accordance with the bimodal distribu-

tion of titers which we previously mentioned. The rates in this case are  $14.2 \pm 1.4$  percent for the urban sample and  $13.7 \pm 1.6$  for the rural group. But whether we consider all titers or only those of 1:16 or higher, the numerical difference between the urban and rural rates is small, and statistical analysis verifies that it is merely a reflection of sampling variation. The probability values are 0.48 for all titers and 0.76 for titers of 1:16 or higher. Thus it is clear that there is no significant difference in prevalence of antibodies between the urban and rural populations of our study.

### Conclusions

The examination of serums from comparable urban and rural Negro populations in Tennessee has shown that the two groups are essentially the same with respect to the prevalence and titer distribution of antitoxoplasmic antibodies. If we accept the presence of these antibodies as an indication of previous infection with *T. gondii*, then we must conclude that, at least insofar as the populations which we studied are concerned, persons living in urban or rural environments have an equal chance of becoming infected with this parasite. (For a discussion of the specificity of these antibodies, see reference 1.) From the epidemiological standpoint, this means that for an explanation of the transmission of this infection we probably must look not to factors associated primarily with one environment or the other but rather to factors common to both. Elucidation of these factors should be the goal of future research in this field.

### Summary

With the Sabin-Feldman dye test, 627 serums from an urban Negro population and 445 serums from a comparable rural population were tested for antitoxoplasmic antibodies. All persons tested were 11 to 19 years old.

Analysis of the results with respect to the prevalence and distribution of titers showed that there is no difference between the sexes at any age; that the titers have a bimodal distribution in both the urban and rural groups, with an abnormally large number of undiluted

*Available methods for isolating, identifying, and tracing to their sources of origin the organic chemicals polluting our water supply are reviewed.*

## Organic Contaminants Affecting the Quality of Water

By F. M. MIDDLETON, B.S., M.P.H., and A. A. ROSEN, Ph.D.

TODAY'S vast chemical industry and particularly its giant offspring, the production of synthetic organic chemicals, have introduced new problems to scientists engaged in providing and protecting the Nation's supply of pure water. By one route or another, these chemicals or the waste products resulting from their manufacture enter the natural environment and affect the water adversely not only for the householder but even for further industrial use. Many of the products, particularly the synthetics, were unheard of a few years ago. Recent and estimated production rates of several of these chemicals are shown in table 1 (1, 2).

Industrial contamination of water, while important, is not the only factor to consider in the complex organic pollution situation. Domestic sewage, natural run-off, and materials derived from the life cycle of aquatic plants and animals contribute substantial quantities of organic materials to streams. Increased supplies of phosphorus and nitrogen from sewage

and other sources may stimulate extensive growth of algae or other aquatic life. Artificial water impoundments also may promote the growth of objectionable organisms.

The complexities of disposal of wastes from the production of organic chemicals have been described by Hess and Carney (3). The residues from large diversified manufacturing processes may contain thousands of complex compounds including byproducts, process aids, unreacted raw materials, and the manufactured product itself. The volume of these wastes may be as large as that of the main product. Effective treatment methods for many of these complex materials remain to be developed. Even when practical and economical treatment has been devised, complete elimination may be impossible.

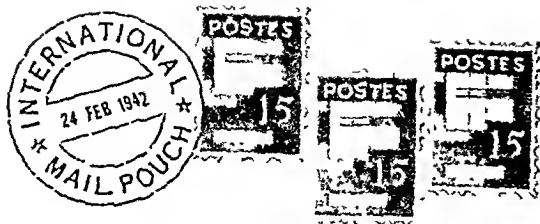
### Effects on Water Supplies

The effects of the diverse mixtures of organic materials on each other, on water, and on the consumer of drinking water are only beginning to be appraised. Among those known are the production of taste and odor in water and interference with treatment of water for industrial and domestic use. Costly ion exchangers deteriorate under the attack of organic chemicals in water (4). Acids are suspected. Polynuclear hydrocarbons possessing carcinogenic

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*These paragraphs, based on overseas reports from public health personnel with missions and field parties of the International Cooperation Administration, give a glimpse into health work abroad. The original material appears in an administrative publication distributed by the Public Health Division of the ICA.*

### **First Movie**

An Arabic language moving picture on sanitation shown for the first time in a Jordan village attracted an audience exclusively of men and boys. In Jordan villages it is not the custom for women to appear at public gatherings in male company. Rather than give up the time needed for a duplicate showing for the women, a sanitarian persuaded the villagers to separate the women and girls from the men and boys by an open aisle. This device permitted the women and girls to see their first movie; it was in fact the first movie for anyone in the village.

—ARTHUR L. DOPMEYER, acting chief, Cooperative Department for Health and Sanitation, United States Operations Mission, Jordan.

### **Latrines for Pilgrims**

Yumbel (population 5,000), seat of the shrine of San Sebastian in Chile, receives as many as 50,000 pilgrims on the peak day of the festival and 80,000 during the week. They arrive on foot, horseback, in oxcarts, autos, trucks, special trains, and even in boxcars. For the first time in the history of the festival, health officials provided latrines for the visitors: 45 prefabricated structures placed in groups around the plaza and walled off to facilitate traffic control and cleaning several times a day. A fee of 5 pesos was charged, if user was able to

pay. Although free service was not denied, 50,000 pesos were collected. The church will pay for the installation cost (280,000 pesos) with funds collected from the pilgrims. It is planned to install 15 more latrines at other points next year. A 10,000 liter tank, a deep well, and chlorinator were installed to supplement the town's usual water supply. The visitors were impressed with the latrines and inquired about means of obtaining them for installation elsewhere.

—PHILIP L. RILEY, acting chief, Division of Health and Sanitation, United States Operations Mission, Chile.

### **Population Gain**

For the first time in the recorded history of Orchid Island, 50 miles off the southeast coast of Taiwan, there seems to be a gain in population as a consequence of DDT spraying for malaria control. Only 1 out of 12 on the island is over 45 years old. The island has no roads, no footpaths more than 18 inches wide. There isn't a wheel to be seen. The children fish. The women grow taros. The older men watch the children. The men wear only a closely tailored fig leaf. The women seem to cover themselves where they happen to be cold.

—JAMES P. WARD, M.D., M.P.H., chief public health officer, International Cooperation Administration Mutual Security Mission to Taiwan.

### **Hard Going**

Heavy floods, deep mud, and washed out bridges forced two physicians to abandon their jeep en route to the Okinawan Colony on the Rio Palmetillas in Bolivia. They crossed two swollen rivers and 5 kilometers of mud on foot to visit the colonists who were preparing to receive about 160 Okinawan immigrants. The colony kindly supplied horses for the return trip. At that point, the physical condition of the villagers was better than that of the doctors.

—GEORGE ADAMS, M.D., M.P.H., chief, Health and Sanitation Division, United States Operations Mission, Bolivia.

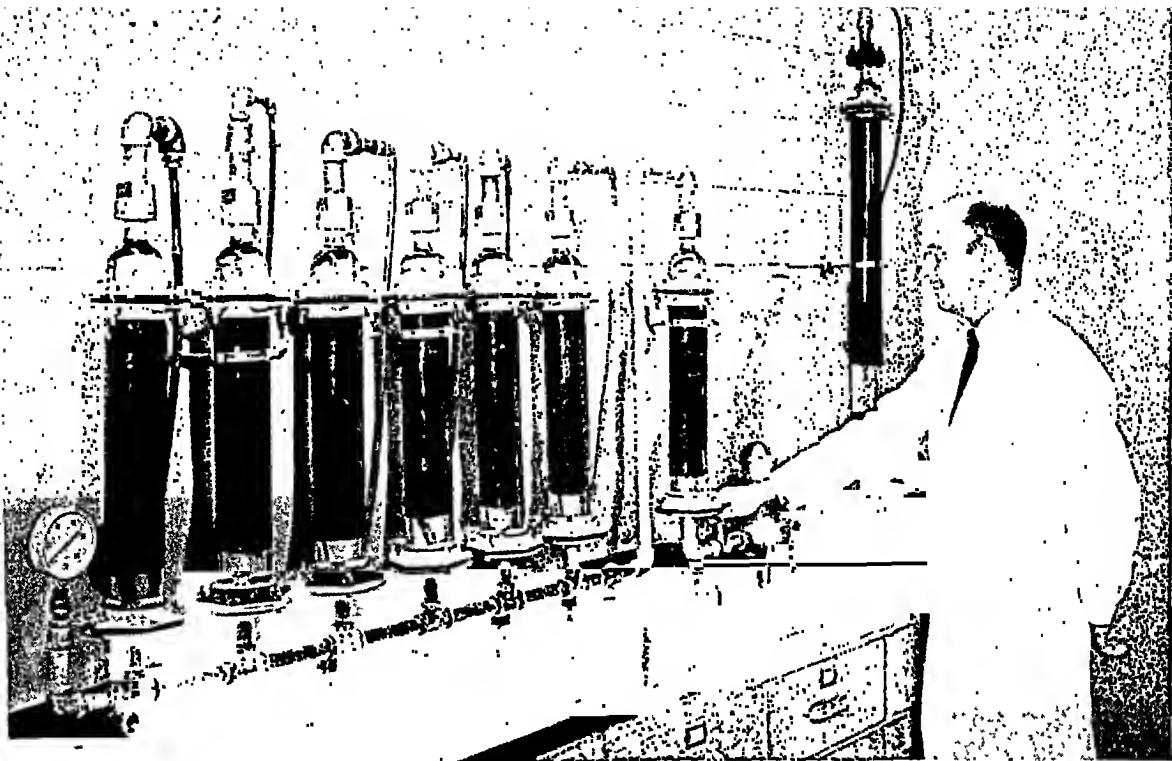


Figure 1. Bank of carbon filters used for collecting small concentrations of organic materials from water. Several thousand gallons of water are passed through these filters which adsorb organic contaminants from the water. The recovered materials are then analyzed for chemical content.

Table 2 lists the concentrations of organic materials recovered by chloroform extraction of the carbon. These materials are frequently sticky, brown semisolids having strong disagreeable odors resembling paint or varnish. Some of the samples show distinct oil layers.

It is significant that the organic materials survive standard water treatment processes and in many instances appear in the finished water in concentrations equal to those found in the raw water.

Little information is gained from the com-

Table 2. Recovery of organic materials from various waters by the carbon filter method

Location	Number of samples	Water source	Sample source	Type of pollution	Recovery of organic materials (parts per billion)		
					Maximum	Minimum	Average
Cincinnati, Ohio...	38	Ohio River.....	Finished water...	Sewage and industrial waste.	630	79	220
Nitro, W. Va.....	14	Kanawha River...	Raw water.....	Chemical waste...	3,060	170	930
Columbus, Ohio...	3	Scioto River.....	do.....	None.....	82	38	62
Piketon, Ohio...	2	do.....	do.....	Sewage and industrial waste.	606	587	597
Wyandotte, Mich...	4	Detroit River....	Finished water...	Industrial waste and sewage.	336	38	203
Saginaw, Mich...	1	Lake Huron.....	do.....	None.....			25

**Table 1. Recent and estimated production of certain synthetic organic chemicals, in millions of pounds**

Year	Detergents	Plastics	DDT	Organic agricultural chemicals	
				Benzene hexachloride	Toxaphene, chlordane, aldrin, and dieldrin
1947			560	8	
1950	1, 660	2, 280		75	40
1952			105	160	115
1955	2, 000	3, 500	125	170	
1960	2, 500	4, 800	155	200	
1975	4, 000	9, 000	200	225	

characteristics were detected by Wedgewood (5, 6) in waste effluents of domestic and industrial origin. An extensive review of the literature on the toxicity of materials known to be discharged into water has been initiated (7).

Taste and odor in drinking water, the most obvious contaminating effect of organic chemicals, is a widespread problem of considerable significance and causes more consumer distress than any other factor in water plant operation. In a 5-year period (1948-52) chemical costs for the control of tastes and odors at the South District Filtration Plant in Chicago (8) amounted to \$462,000, equivalent to 21.7 percent of the total chemical cost. More than 1,000 water plants in the United States use active carbon for the control of taste and odor. While carbon treatment and other methods for controlling these objectionable conditions have been developed, difficulties are frequently such that the required treatment cannot be provided.

An indirect effect on health arises when unpalatable water causes the consumer to seek other drinking water sources—even bacterially contaminated ones.

### Isolation and Identification

The organic chemicals occurring in water are usually present in very low concentrations, but a few parts per billion (p.p.b.) of contaminants may produce significant taste and odor. One part per billion is equivalent to a teaspoonful of material in 1 million gallons of water.

The low concentrations, complexities, and

varieties of organic pollution in water make the recovery and identification of these substances difficult. Specific methods, with few exceptions, for the analysis of the multitude of organic chemicals in water are lacking. Furthermore, ordinary analytical techniques are usually inapplicable to the extremely low concentrations which must be studied. Some means of concentrating the materials for analysis is necessary. Methods for concentrating, isolating, and identifying these materials have been under study by the Public Health Service at the Robert A. Taft Sanitary Engineering Center. Exploiting the unique adsorptive properties of active carbon, a filter has been developed which adsorbs most organic material from water. After water or wastes in quantities from 100 to several thousand gallons pass through the filter, the carbon is dried and the organic materials are extracted with chloroform or other organic solvent in a Soxhlet extractor.

The organic substances recovered from the carbon differ with the type of solvent used for the extraction. Chloroform, the solvent used in most studies, has been found to recover those substances principally responsible for undesirable taste and odor in water. Alcohol will remove a quantity of material equal to or greater than the amount recovered by the chloroform even after preliminary extraction by chloroform. These highly water-soluble materials recovered by alcohol appear to have relatively little significance as taste and odor factors. Most materials investigated for their taste and odor effects are adsorbed quantitatively by carbon, but desorption by chloroform is only 65 to 80 percent complete. Following extraction, the solvent is removed by distillation, and the residue is subjected to further analysis. Liquid-liquid extraction methods also have been utilized for concentration of materials from some effluents.

Details of the use of the carbon filter (fig. 1) and certain applications, particularly to taste and odor studies, have been described (9, 10).

### Raw and Finished Water Studies

Raw and finished waters have been sampled by means of the carbon filter in several locations and under various conditions of pollution.



**Table 3. Chemical groups separated from carbon filter extracts of water samples taken from seven sources**

Chemical group	Source, location, and type of water sample						
	Scioto River, Columbus, Ohio (tap)	Scioto River, Piketon, Ohio (raw)	Ohio River, Cincinnati, Ohio (tap)	Lake St. Clair, Mount Clemens, Mich. (raw)	Lake Michigan, Waukegan, Ill. (raw)	Big Sandy River, Catlettsburg, Ky. (raw)	Activated sludge sewage treatment plant, Richmond, Ind. (effluent)
Ether insoluble.....			6.2				
Water soluble.....		10.2	24.3	2.2	15.4	8.6	
Amine.....	5.5	2.4	3.2	1.6	4.3	2.4	8.6
Weak acid.....	12.1	6.2	16.7	17.2	20.4	14.0	30.0
Strong acid.....	12.1	11.3	14.0	13.0	7.9	13.4	21.8
Neutral.....	70.5	69.9	37.2	66.0	53.0	62.0	39.4

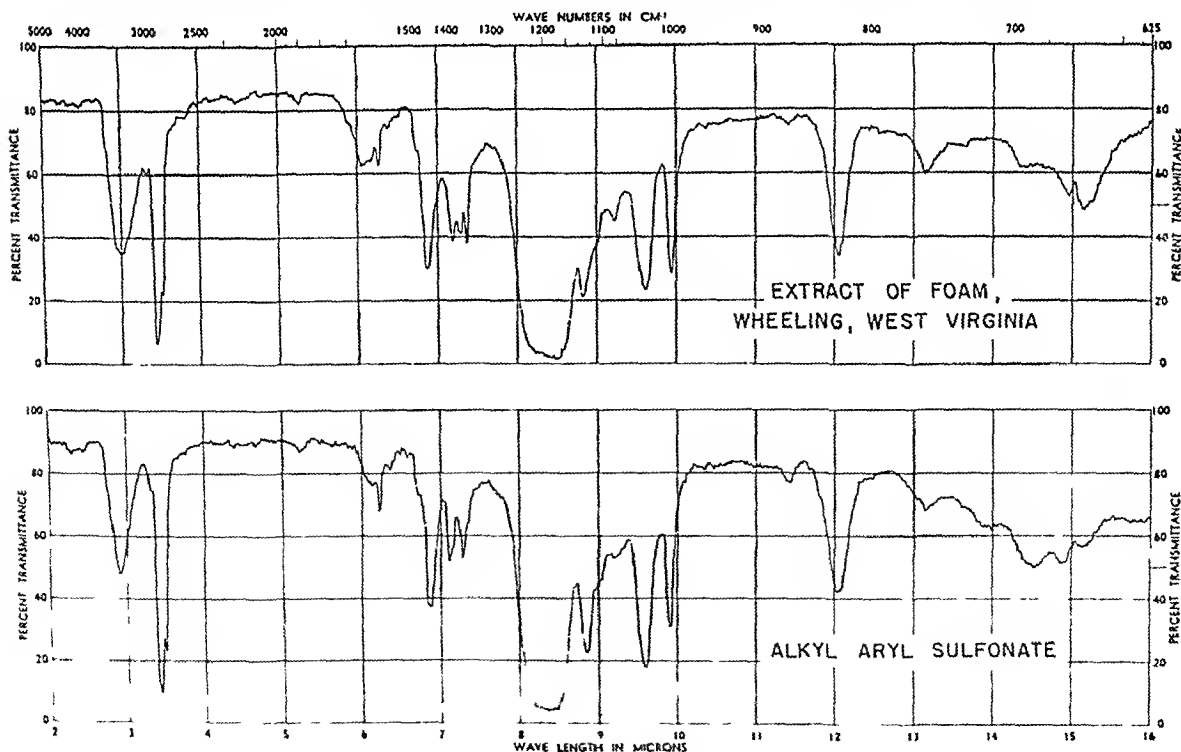
water in an area well known for the manufacture of petrochemicals. Acrylonitrile was indicated to be a component by infrared tests. While the toxicity of these organic cyanogen compounds is not great compared to the alkali cyanides, their presence in drinking water merits further study. Alcohols, aldehydes,

ketones, acids, and esters have been found in various waters. Some of these appear to be of industrial origin while others may be naturally produced.

#### Insecticides

Concentrations of DDT in the range of 1 to 5 p.p.b. were found in the drinking water of sev-

**Figure 2. The similarity of these infrared spectrums indicate that foam material from the raw water at Wheeling, W. Va., contained large amounts of anionic synthetic detergents.**



plex residue without further chemical separation. Utilizing solubility differences, the materials are separated into the broad groups of water-solubles, acids, bases, neutrals, and phenolic materials. The distribution by groups of the chemicals recovered from various waters is shown in table 3.

The neutral materials, whether the pollutants are of industrial or natural origin, generally constitute the most abundant group. Since neutral substances are less reactive than other classes of compounds, they can be expected to resist biological and chemical attack to a greater degree. However, even hydrocarbons that are quite stable chemically may be attacked biologically. Neutral compounds which may occur in water are aliphatic and aromatic hydrocarbons and their halogen derivatives, alcohols, aldehydes, ketones, ethers, esters, nitro compounds, amides, nitriles, sulfides, and many others. The neutral substances are frequently sources of intense odor which can be detected when only a few parts per billion are present.

### Hydrocarbons and Related Materials

Aliphatic and aromatic hydrocarbons have been consistently isolated from drinking waters obtained from sources in the vicinity of petroleum refinery waste outfalls. These materials survive water treatment processes in concentrations sufficient to cause serious impacts on taste and odor. Associated with these materials are sulfur compounds, probably cyclic sulfides, also responsible for odor in water. A study of taste and odor components in refinery effluents and a method for identifying petroleum wastes in surface waters have been published (11, 12).

As much as 1 p.p.m. of organic material was recovered in the drinking water of a city located 10 miles below an area containing a concentration of chemical industries. Materials found include substituted benzene compounds, kerosene, polycyclic hydrocarbons, and phenyl ether. Intense odor was a pronounced characteristic of the recovered materials. The phenyl ether recovered was detectable by odor tests at a concentration of 5 p.p.b.; the pure laboratory reagent at 13 p.p.b.

Phenolic compounds have long been recog-

nized as being detrimental to water quality, particularly from the standpoint of taste and odor. These compounds are associated with waste products from coke plants, oil refineries, and other industries. The taste and odor intensity of many phenolic substances is increased several hundredfold when reacted with the low concentrations of chlorine ordinarily used at the water treatment plant. A 1 p.p.b. concentration of the chlorinated materials may be detectable by taste and odor. However, phenolic pollution is more amenable to control at the water plant than other types of pollution.

Petrochemical wastes have presented problems recently. No standard definition of the term "petrochemical" is available but the book "Petroleum Processing" suggests:

**PETROCHEMICAL**, *n.*: A chemical compound or element recovered from petroleum or natural gas or derived in whole or part from petroleum or natural gas hydrocarbons, and intended for chemical markets.

Included in this group are such familiar chemicals as alcohols, benzene, ammonia, carbon black, acetone, aniline, styrene, and sulfur. Wastes from the manufacture of these materials are complex and highly odorous. Where wastes are discarded into streams without adequate treatment, outbreaks of intense taste and odor have occurred. On one occasion, under winter conditions, the taste and odor were reported to have traveled 1,000 miles. The waste materials responsible were recovered from drinking water 400 miles from the point of discharge and were partially identified.

The development of the petrochemical industry has come about almost entirely since 1940. It is estimated that, at present, there are over 300 petrochemical plants (13) in operation in this country. In 1954, this industry produced 27 billion pounds of petrochemicals comprising approximately 25 percent of the total chemical production.

The rate of expansion of petrochemical production indicates that in 1965 this industry will be the source of half the chemicals produced in the United States. The extensive uses of petrochemicals derived from crude oil and natural gas cracking are summarized in the inset (p. 1130).

Nitriles have been isolated from drinking



**Figure 3.** Picture of frothing conditions of sewage plant at Benton Harbor, Mich. The exact causes of this foaming condition are not known but synthetic detergents have been implicated. Analysis has shown large quantities of detergents in the foam.

such materials as DDT in water may not be significant from the standpoint of human physiological effects, concentrations below 1 p.p.m. of chlorinated insecticides are toxic to fish (16); toxaphene (17) has been reported to be lethal to fish in 10 days at less than 6 p.p.b. concentration.

### Synthetic Detergents

Synthetic detergents as potential water polluting materials are receiving much more attention since the occurrence of excessive foaming at water plants in Kansas and West Virginia (18, 19). These materials are unique in that virtually all of the product ends up as waste. A review of the detergent problem has been published (20). Foam materials from Wheeling, W. Va., were identified by means of infrared spectrums as originating from synthetic detergents of the alkylarylsulfonate type (anionic). (Approximately 80 percent of all detergent produced is of this type.) The striking resemblance of the infrared spectrums of the pure material and materials recovered from the foam (fig. 2) leaves no doubt as to the presence of surfactant in the foam. Tastes, odors, and interference with water treatment

have been ascribed to the presence of these materials in concentrations of a few parts per million. This concentration does not normally occur in water. These substances are resistant to biological forces of purification in the stream and will survive usual water treatment processes although they are readily adsorbed by active carbon. Small concentrations have been isolated from tap water, and the materials undoubtedly constitute a portion of our daily organic intake with drinking water.

Sewage treatment plants have experienced troublesome foam problems. Foaming may be due to causes other than detergents, but in a number of instances high concentrations of anionic materials have been present in the foam materials. Samples of the foam from the Benton Harbor, Mich., plant (fig. 3) were shown by infrared methods to be high in detergent materials. A report (21) has described the difficulties of the frothing at this plant.

### Natural Materials

Products of natural origin in water are frequently responsible for taste and odor difficulties. In addition, kills of wild and domestic

eral cities using rivers as sources of supply. The insecticide could not be recovered at all times but persisted for a 6-month period in one location. The major source of the DDT was presumed to be spray operations.

Through the widespread agricultural use of

DDT, exposure resulting from various sources (14, 15), particularly food, is much higher than the exposure that could result from ingesting drinking water containing a 5 p.p.b. concentration, the estimated maximum level found in the waters examined. Although present levels of

## Basic Petrochemicals and End Products

CRACKING

OXIDATION

OTHER CHEMICAL TREATMENT

*of crude oil and natural gas*

<b>give</b>	⌘	methane	ethane	propane	butane	ethylene	acetylene
		butadiene	naphtha	butylene	propylene	cyclopentadiene	
		isoprene	isobutylene	benzene	cyclohexane		

<b>which</b>	⌘	<b>synthetic fibers</b>		
		acetates	acrylics	polyesters
		nylons	vinyls	

<b>are</b>	⌘	<b>synthetic rubbers</b>		
		butyl	GR-S types	neoprene
		nitrile	polyurethane types	

<b>used</b>	⌘	<b>plastics, resins</b>			
		alkyds	epoxys	phenolics	polyesters
		polyethylene	styrenes	vinyls	

<b>make</b>	⌘	<b>automotive chemicals</b>		
		antifreezes	hydraulic fluids	oil additives
		tetraethyl lead fluid	other gasoline additives	

**also these other important end products**

alcohols	detergents	drugs	explosives	glycerin	ketones
miscellaneous solvents		nitrogen fertilizers		pesticides	
plasticizers	protective coatings	refrigerants	rocket fuels		

SOURCE: The Chemical Industry Facts Book, 2d Ed., Manufacturing Chemists Assoc., Inc.

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## technical publications

### The Dentist in the U. S. Public Health Service

*PHS Publication No. 475. 20 pages; illustrated. 15 cents.*

Opportunities for dental officers in the commissioned corps of the Public Health Service are shown in this booklet. It outlines the admission requirements for the Regular and Reserve Corps and describes the integration of dental research, clinical dental practice, and dental public health within the Service.

Basic, clinical, and applied research are conducted, respectively, at the National Institute of Dental Research, the Clinical Center of the National Institutes of Health, and the Division of Dental Resources.

Dentists are assigned to treat merchant seamen, Coast Guardsmen, Indians, and other eligible groups at Service hospitals and outpatient clinics.

Preventive measures which can be widely applied are the responsibility of the Division of Dental Public Health. Here dental officers develop

or improve methods of preventing or controlling dental diseases. They may also be assigned to provide consultation and assistance to States and communities endeavoring to improve dental health.

### Clinical Memoranda on Economic Poisons

*PHS publication (unnumbered). 1956. 78 pages. Multilithed.*

The Technical Development Laboratories of the Communicable Disease Center has issued its annual revision of the material on economic poisons (see *Public Health Reports*, September 1955, p. 836).

The book is divided into five sections: organic phosphorus insecticides, chlorinated hydrocarbon insecticides, solvents, rodenticides, and miscellaneous compounds.

Each section gives general information applicable to the group of compounds under consideration, and

each memorandum gives information on the identity, formulations, and uses of a poison. Toxicology of the poison with specific reference to human cases, its dangerous dose to man, laboratory findings, and treatment are discussed.

Appendixes A-E give instructions for collecting and shipping of samples for the analysis of pesticides or determination of their physiological effects.

Copies are available from the Communicable Disease Center, Public Health Service, Atlanta, Ga.

This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

animals have been associated with blooms of certain toxic algae. Odors of these materials are often described as musty, earthy, pigpen, geranium, fishy, and cucumber. Many of these odors have been associated with algae. Silvey (22, 23) has proposed that actinomycetes are responsible for musty and other odors in various waters, particularly in the southwest. The chemicals elaborated by the organisms have not been identified. A musty component has been recovered from numerous waters in the Cincinnati laboratory by extended purification following steam distillation of the neutral materials. This material constitutes a very small percentage of the total extract but possesses an extremely intense odor.

Waters from various surface sources have contained substantial quantities of carbonyl compounds. Such materials as organic acids, ketones, and aldehydes may result from natural decay, oxidation, and life and death processes of plants and other aquatic life. Organic acids may also represent an intermediate step in the oxidation of industrial materials, including hydrocarbons. Hence identification of these materials does not reveal their origin.

Much remains to be learned of all the effects natural products have on the pollution of our water resources. One objective of studies in progress at the Robert A. Taft Sanitary Engineering Center is the determination of the role of algae as sources of taste and odor. Further chemical studies are being pursued in areas experiencing difficulties in taste and odor where nonindustrially polluted waters serve as a source of supply.

### Summary

Water quality is seriously affected by contamination from organic materials. Both drinking water and industrial supplies are impaired. Apart from the nuisance and deprivation caused by effects on drinking water, it is conceivable that physiological effects may result from high concentrations of these materials in public water supplies. At what concentration materials such as those isolated from drinking water constitute a hazard is not known. Many of the organic materials in water have not yet been isolated or identified.

Methods for studying these materials have been indicated and some of the results outlined. In view of the increased industrialization, increased water use, and the present lack of knowledge of natural pollutants, the total effects of organic chemicals on water quality and means for the control of the materials demand increased attention.

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million men with a history of tobacco use, 31 million had smoked cigarettes regularly at some time during their lives. The corresponding numbers of lifetime male cigar and pipe smokers were 4.8 and 7.9 million, respectively. The numbers of current regular male smokers were as follows: cigarettes, 26 million; cigars, 2.8 million; pipes, 3.9 million. Of the 18 million women who reported some use of tobacco, 15 million had at one time or another been regular cigarette smokers. Thirteen million were regular smokers at the time of the survey. All of these estimates have been adjusted to take account of persons in the sample for whom no smoking histories were obtained.

Cigarettes are the major form of tobacco used. Trade sources estimate the number of cigarette smokers at about 60 million, and this figure probably includes "discontinued" smokers. If one adjusts the survey results to include occasional smokers, persons in military service and in institutions, and smokers presently under 18 years of age, the maximum resulting estimate of cigarette users to be derived from the survey is about 55 million. Some of this discrepancy between the survey estimate and that of trade sources may be traced to different estimates of the proportion of women smokers.

The profiles of age and sex differentials in tobacco use resulting from comparisons based on current practices or lifetime history of use are very similar, particularly for cigarettes. The highest percentage of current regular cigarette smokers appears at 25-34 years of age among both males and females and tapers off in successively older groups. The sex differentials in the proportion of smokers (or nonsmokers) is greatest at ages over 65. Among men over 65 years of age, pipe smoking rivals cigarette smoking in popularity. The differential in favor of cigarettes widens at the younger ages. Moreover, in the younger cohorts there seems to be a shift to "pure" cigarette smoking, accompanied by a lessened tendency to take up cigars or pipe exclusively.

A shift to an earlier age for starting to smoke is observed for younger persons. This has accompanied the rising proportion of regular smokers in these younger age groups. The smoking habit characteristics of a cohort become evident by a rather early age, around

age 18 to 20 for men and at a slightly older age for women. Much of the decline in the number of cigar and pipe smokers may be traced to a failure of these forms of smoking to attract converts at an early age among persons born since 1900.

Aside from differences associated with age and sex, urban-rural residence is the population characteristic which differentiates smoking habits most sharply. Rural nonfarm persons closely resemble urban dwellers in smoking habits, and the sharp demarcation appears between the rural nonfarm and rural farm populations. The farm and nonfarm populations acquire the smoking habit at virtually the same age as the urban population. Among men, the urban-rural differences are emphasized when comparison is restricted to cigarette smokers using more than one pack of cigarettes daily. Cigarette smoking has been increasingly accepted by urban women born after 1890. Sizeable acceptance among farm women was delayed almost one generation, to women born after 1920.

Practically no differences in smoking patterns according to size of urban community were noted. This finding is at variance with earlier surveys and suggests that the events of the past 20 years have disposed of community size as an important determinant in shaping smoking habits.

For men, there is little variation in the distribution of smoking patterns in the four major regions of the country (Northeast, North Central, South, and West). The proportion of female nonsmokers is lower in the northeastern and western regions than elsewhere. A higher proportion of heavy cigarette smokers was noted among northeastern males and the excess cannot be accounted for solely by greater urbanization of that area.

The differences between whites and nonwhites with respect to the proportions of nonsmokers and of all regular cigarette smokers are trivial. However, the proportion of white male cigarette smokers who use more than one pack of cigarettes daily is almost double the proportion among the nonwhite males. A similar excess occurs among white females. Urban-rural gradients provide another distinction. Among white males, the rural nonfarm data on tobacco use resemble those for the urban population.

# *A Survey of Tobacco Smoking Patterns in the United States*

As a supplement to the United States Bureau of the Census Current Population Survey for February 1955, smoking histories were collected from approximately 40,000 men and women 18 years of age and over. Persons in the survey were a representative cross section of the population of the United States. The questionnaire regarding smoking history was similar to that used by the American Cancer Society and the National Cancer Institute in their forward studies on the association of smoking and lung cancer. The questions covered the use of cigarettes, cigars, and pipe tobacco, attempted to distinguish between occasional and regular smokers, and included items on age at which smoking was started and the maximum consumption rate ever attained. The census information on age, sex, residence, race, and other population characteristics was made available for analysis.

The survey objective was to classify the population by broad smoking categories, and no attempt was made to validate verbal statements on rate of use by diaries or other records of consumption or purchases. Current cigarette consumption as estimated from the survey data was checked against the national aggregate consumption determined from tax data, which indicated that the survey underestimated cigarette consumption by approximately 15 percent. Considering the different intent for which the questions on smoking were designed, the correspondence between the survey and tax estimate seems good.

Of the 49.6 million men and 55.1 million women 18 years of age and over in the civilian population outside institutions, 11 million men (23 percent) and 37 million women (67 per-

cent) are reported to be nonsmokers, that is, they had never smoked tobacco occasionally or regularly in any form. Of the remaining 38



Public Health

MONOGRAPH

No. 45

The accompanying summary covers the principal findings presented in Public Health Monograph No. 45, published concurrently with this issue of Public Health Reports. Mr. Hoenszel and Dr. Shimkin are with the National Cancer Institute, National Institutes of Health, Public Health Service, Bethesda, Md., and Mr. Miller is with the U. S. Bureau of the Census.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

Haenszel, William, Shimkin, Michael B., and Miller, Hermon P.: Tobacco smoking patterns in the United States. Public Health Monograph No. 45 (Public Health Service Publication No. 463). 111 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956.



# The Nationwide Fight Against Blindness

By FRANKLIN M. FOOTE, M.D., Dr.P.H.

TO ATTEMPT to envisage the estimate of 334,000 blind persons in the United States, imagine a city as big as Miami, Fla., or Omaha, Nebr.—a city in which every man, woman, and child is blind. It is further estimated that more than 27,000 persons lose their sight each year and that, unless our preventive efforts can be made more effective, three-fourths of a million persons now living will become blind before they die. The cost of caring for the blind—education, braille and talking books, seeing-eye dogs, lighthouses, pensions, and other of the inadequate services we try to provide—amounts, according to the American Foundation for the Blind, to \$150 million each year.

Fortunately, there has been considerable progress in preventing blindness. Infectious causes of blindness show a great drop. When the National Society for the Prevention of Blindness was established in 1908 by Miss Louisa Lee Schuyler and Dr. F. Park Lewis, almost one-third of the children in schools

for the blind were there because of ophthalmia of the newborn. The crusading spirit that brought about legislation in every State requiring the use of prophylactic drops in the eyes of every newborn child, coupled with antibiotic treatment of those rare cases which now occur, has brought this cause of blindness to the vanishing point. Health education plus sulfa treatment have almost wiped out trachoma in this country. Although smallpox is responsible for 10 to 20 percent of blindness in some countries which have not had the benefits of the advancing medical sciences, it is virtually unknown here. In only 20 years there has been a reduction of 60 percent in syphilis as a cause of blindness among children in schools for the blind because many States have enacted wise legislation requiring blood tests before marriage and early in pregnancy. Health education and effective treatment of infected patients also have reduced the effects of syphilis.

Even eye injuries as a cause of blindness among children in schools for the blind show a significant decrease: 40 percent in the past 20 years. This decline can perhaps be attributed in part to sound legislation such as that controlling sale of the more dangerous kinds of fireworks and controlling use of air guns, in part to health education of young parents by public health nurses and social workers, and in part to improved methods of therapy.

Retrolental fibroplasia as a cause of blindness has come to play an all too prominent role. It is estimated that there now are 8,000 children blind from this one cause. For years, the National Society for the Prevention of Blindness has been interested in promoting research on this problem. The organization established

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Among nonwhites, the reverse is true, the non-farm data resembling those for the farm population.

Smoking is less prevalent among farmers than among other male occupational groups. Among nonfarm workers, professional and technical personnel had the highest proportion of nonsmokers. There is evidence of some ordering by social class, the white-collar groups having more nonsmokers than craftsmen or operatives. This ordering by social class, noticeable for nonsmokers and for all regular cigarette smokers, tends to disappear when comparison is limited to smoking more than one pack of cigarettes daily.

The survey data support the observation that military life encourages the adoption of the smoking habit. The greater use of tobacco among soldiers persists after they leave military service.

The results by marital status point to a small deficit of smokers among single persons of both sexes. The proportion of nonsmokers among divorced persons of each sex is lower than for the remainder of the population.

Proportionately more men than women were reported as discontinued smokers at the time of the survey. When sex differences in the number of smokers and length of exposure to the habit are taken into account, the difference

between men and women with respect to discontinuance disappears. For cigarettes particularly, discontinuance rates fall into consistent age patterns and show some stability over a variety of population groups, although in examining the data by population subgroups, a rather general inverse relationship between the proportion of regular smokers and the discontinuance rate does appear. It does not appear necessary to qualify group comparisons, based either on maximum or current rate of smoking, by taking into account the effect of discontinuance on duration of exposure to the habit.

The major purpose in collecting smoking histories was to investigate the meaning of the reported associations between smoking and lung cancer and to check whether the distribution of lung cancer deaths is consistent with estimates of the excess risk among smokers and the distribution of smokers in the population. The application of the data to test proposed models for lung cancer etiology was reported in the *Journal of the National Cancer Institute*, June 1956. This report is devoted solely to presentation of the census findings, and it is hoped that these data may prove useful to persons interested in the social, economic, and marketing aspects of tobacco use, as well as to investigators interested in lung cancer.

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### Correction

In table 2, page 654, July 1956 (Effect of Fluoridated Public Water Supplies on Dental Caries Prevalence, by F. A. Arnold, H. T. Dean, P. Jay, and J. W. Knutson), the def rate for 7-year-olds in 1950 should read 4.72, and the def rate for 11-year-olds in 1953 should read 1.09, both in Grand Rapids, Mich.; in table 3, page 655, the DMF rate for 6-year-olds in Grand Rapids in 1953 should read 0.19.

react as did 69 percent of the eye patients in a recent study made by a California oculist (1). Since they never before had heard of the disease, how could they understand its implications? Many persons may believe that eyedrops advertised in a bus, new eyeglasses, or even proper illumination are all that is needed to treat or avert what you and I know to be serious conditions.

### **Need for Continuous Education**

In 1951, Owens, Cox, and Hochreiter (2) reported on 100 blind persons in the Baltimore area in an attempt to determine why they had lost their sight. For approximately half the patients, they found that either there was no effective care or treatment available or, if available, that everything possible had been done at the right time, without avail.

For the other half, it was felt that blindness could have been prevented but was not for various reasons. For 31 out of 50, the reason was attributed to the patient: lack of knowledge of early symptoms of eye disease and the importance of seeking and carrying out competent ophthalmological advice. In some cases where the patient sought advice from the family doctor or some other practitioner, referral to an ophthalmologist was not made for many months or even years. A few of the preventable cases of blindness were from accidents.

Medical societies and departments of public health are doing much to inform the public on health matters in general, but their efforts in so specialized a field as blindness prevention need reinforcement. Therefore, a voluntary citizens' agency, such as the national society, in which both professional and informed lay persons are joined in partnership, can make a significant contribution in bringing about a more informed public. If he is one of those who has been informed, an eye patient will be more likely to cooperate in the plan of treatment outlined when told of the diagnosis and the regimen to be followed.

### **The Mass Media**

Our public education program has become more effective since we have given it full-time

attention. The month of September 1955 was again proclaimed "Sight Saving Month" by 30 State governors and by many mayors. Because the national Advertising Council approved this intensive campaign, it is estimated that more than a million dollars' worth of radio and television time was devoted to messages about care of the eyes. Science reporters and magazine writers in increasing numbers are coming to our headquarters for suggestions and to verify their data. During the past 3 years several magazines which reach millions of persons have carried well-written and scientifically sound articles on eye problems, whereas less than 20 years ago no such story had ever appeared in the mass media. Although misleading articles and those apparently designed for self-promotion are published occasionally, the careful checking being done by many magazines and newspapers indicates vast improvement in the reliability of the material they use.

Aside from the mass media of communication, the national society works with all professional groups that are or should be interested in sight conservation. For instance, some of our information efforts are directed toward keeping the general medical practitioner and the pediatrician up to date on advances in ophthalmology.

### **Local Programs**

One of our departments works with teachers colleges and State and local departments of education to keep the million school teachers of our country alert to eye health problems. To improve vision screening programs for school and preschool children, the national society has helped to support important research on vision testing, and our nurse consultant works with public health nurses and volunteer groups.

The value of medical social service activities has been clearly demonstrated in such centers as the eye and ear infirmaries of Massachusetts and of Illinois. Our staff medical social work consultant seeks to improve the provision of followup for eye clinic patients and those needy persons being served in State and local welfare programs.

Because we have not yet arrived at that millennium when all persons have chosen an eye

a committee in 1951 which finally led to a coordinated attack on blindness, participated in by 18 hospitals and 75 investigators and sponsored by the Public Health Service's Institute of Neurological Diseases and Blindness, the National Foundation for Eye Research, and other agencies as well as the society.

Although the entire story of the mechanism of how oxygen leads to retrolental fibroplasia and how oxygen can be given when necessary without producing blindness has yet to be elucidated, steps already taken to avoid excessive administration of oxygen to premature infants have virtually eliminated this cause of blindness from many hospitals. In the State of New York, 18 newborn infants were reported to the Commission for the Blind in 1954 as being blind from this disease in that year. In 1955 this figure had dropped to 3. The national society has contributed more than \$40,000 in grants-in-aid for research in retrolental fibroplasia.

The discussion thus far—ophthalmia of the newborn, syphilis, injuries, and retrolental fibroplasia—has provided examples of primary prevention, action to prevent blindness even before the cause begins to operate.

### Impact of the Later Years

Despite the progress that has been made, there is reason to believe that the actual number of the blind in the United States is increasing. This increase is in part produced by our increases in population. In part it also reflects the advances made in the past 50 years which have added 20 years to the average span of life—from 48 in 1900 to 69.6 at present. Today, many more persons live to an age when glaucoma, cataracts, and other eye diseases are more frequent and when such diseases as diabetes and arteriosclerosis produce loss of sight.

The chronic eye diseases of middle and later life constitute a much greater problem than those discussed earlier. Many of them cannot be cured in the light of our present knowledge, and the best we can hope to do for some of these conditions, such as glaucoma, is to retard them. This kind of prevention of disability is coming to be known as secondary prevention: The disease is clearly present, but something can be done through early detection and

optimum treatment to prevent or at least to lessen the extent of disability. In some instances, such as cataracts, retinal detachment, and corneal disease, surgery often restores sight if performed at the proper time.

Much of the prevention of blindness in the past has been accomplished by influencing relatively small numbers of people. For example, boards of education can require vaccination against smallpox before a child enters school; then their staffs will see to it that every child is vaccinated. Boards of health or State legislatures can require the use of prophylactic drops in babies' eyes immediately after birth, and proper enforcement procedures will make sure that this is done. Hospitals can require adequate control of oxygen if it is prescribed for a premature infant, and we should have little or no more retrolental fibroplasia.

But there seems to be no easy procedure that we can direct people to follow to prevent blindness from most of the eye conditions of middle and later life. The patient with a detached retina needs early and competent care if the required surgery is to be successful. The patient with acute uveitis, with glaucoma, with many other conditions, needs early care and needs to follow the oculist's instructions to the letter if he hopes to avoid loss of sight. The patient with a detached retina must get into the proper hands, accept the diagnosis, and be willing to have an operation promptly.

This means that we are discussing individual, highly personal problems. It means that we must somehow influence in the right way every one of the 167,000,000 persons in the United States if we are to make progress in combating blindness from these causes.

The average person, in my opinion, does not like to go to a doctor, even when he has serious eye symptoms. Even though he is frightened by the idea of blindness, he has a good deal of inertia and hopes that somehow his eye trouble will go away by itself, the way it came. He did not ask for his symptoms and cannot understand why he should be bothered by them. I think he would far rather buy a new television set than pay for an eye examination, and if, by some chance, the eye examination reveals nothing wrong, he feels cheated. If a serious eye disease such as glaucoma is diagnosed, he may

hances or adds pleasure to life. In view of what America is willing to spend on products of such ephemeral value, though, this Nation will certainly appreciate the greater and more lasting value of research and prevention. If we can stimulate such research and apply present and future knowledge to the prevention of blindness, our progress will exceed even the impressive advances already achieved.

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## Air Pollution Demonstration Projects

A grants-in-aid program for demonstration projects related to air pollution and its control has been established by the Public Health Service. These projects are for the purpose of evaluating or demonstrating the effectiveness of various methods of preventing and combating various air pollution problems.

State and local government air pollution control agencies and other public agencies may apply for grants-in-aid for air pollution demonstration projects at any time.

Applications will be reviewed on the basis of the relative need for such a project; the adequacy of facilities and skills available; the characteristics of the air pollution problem in the area; how the results will apply to other parts of the country; and how much the applicant can contribute to the total cost of the project.

Grants for demonstration projects will be for a specific amount paid in a lump-sum to the grantee for 1 year. They may be renewed for two additional periods of 1 year each, depending on the availability of Federal aid. Demonstration project activities must begin within 6 months after the grant is approved and must be used only for the specific project.

Information about these grants may be obtained from any of the Regional Offices of the Public Health Service or from the Chief, Division of General Health Services, Bureau of State Services, Public Health Service, Washington 25, D. C.

doctor and go to him periodically for an eye checkup, it seems well to encourage experimentation with screening programs for adults as well as for children. Among adults, it is evident that a screening test for visual acuity, ophthalmoscopic examination, taking the tension with a tonometer, and possibly using the Harrington multiple-pattern test of field of vision will discover about one person in 50 over the age of 40 years with glaucoma (3-5). Where such surveys have been conducted, at least one result has been that everyone concerned has learned what glaucoma is and what value there is in early diagnosis and continued treatments.

In vision screening activities, participated in by the national society in various States, an important byproduct has been the education of volunteers assisting in the programs. In the course of their training, hundreds of volunteers have become informed about such eye topics as the need for early care of children with strabismus. They have learned that there is no such thing as a "minor" symptom of eye trouble and that what might appear to be a relatively trivial symptom, such as slight blurring of vision or difficulty in reading the newspaper, may be the only early warning sign one will have of so dangerous an eye disease as glaucoma. Nearly all these volunteers are women, and their new-found knowledge finds its way to club meetings, coffee parties, and bridge games. A well-trained volunteer may help to pass on information to 5 or 10 other adults.

### **Safety Glasses in Industry**

It is estimated that 300,000 eye accidents still occur each year in industry, in vocational shops, and at home. Our objective in industry is to promote not only eye safety but also improved screening programs which will help to reveal otherwise unrecognized eye disease. Eye safety is being aided by an incentive program known as the Wise Owl Club, which originated in St. Louis in 1947. Admission to this exclusive club is won by a worker if his eyesight has been saved by the conscientious wearing of safety glasses at the time a work accident occurs.

The occasion of an award dramatizes the fact that a man's vision has been saved, a fact that

otherwise might pass unnoticed. We now have records on nearly 10,000 Wise Owl members who have had the sight of at least one eye saved by wearing safety glasses. More than one-fourth of this group saved the sight of both eyes. This is an impressive number of men and women who would be blind but for the preventive measures that have been accepted.

### **Need for Research**

The Baltimore study by Owens showed that about half of the blindness now occurring could not have been prevented no matter what was done. The need for both fundamental and clinical research in the blinding eye diseases is therefore obvious. The support that the national society has given to some projects in this field has already been indicated. We have also tried to stimulate the interest of various foundations in the field of eye research, and at various times have presented information on the need for ophthalmic research to congressional committees. In the early days of the national society, it had become apparent that there was need for data on the extent of blindness, on the relative importance of various causes, and on their incidence by sex, age groupings, race, and geographic factors. When the material produced by our statistical division (6) was presented to a congressional committee in a fact sheet in June 1949, Committee Chairman Percy Priest called it "very helpful."

It has already been noted that blindness is costing us at least \$150 million each year. In contrast, the American people are allocating not more than \$3 million, or possibly 2 percent of this amount, to eye research and to organized programs for prevention. One might ask whether we can afford to put more into prevention and into research. The answer lies in our sense of values, indicated by retail sales of nonprescribed eye lotions and eye washes in the amount of \$4,910,000, and mascara, eyebrow pencil, and eye shadow to the sum of \$7,180,000 (7). And, of course, billions more are spent on commodities and services which are far less valuable than the protection of human eyesight.

In quoting these figures I do not wish to imply that anyone should be deprived of what en-

advised to douche and refrain from sexual intercourse for at least a week. They were asked to return in 1 week and again in 4 weeks when re-examination and repeat smears were taken. Any patients whose smears were positive were re-treated with the same schedule as before.

## Results

On pretreatment examination, 122 of the original 150 women in the study were found to have a smear positive for gram negative intracellular diplococci from either cervix or urethra, or both. Of these 122 women, 85 (70 percent) were treated. They returned to the clinic as directed for two followup examinations. Smears taken at these examinations were negative for the diplococcus. Thirty-four women failed to return, while three who completed the followup were found to be positive for the diplococcus. Of the original 150 women in the study, 28 had negative smears on initial examination and smears continued to be negative throughout the 30 days during which they were under observation. Of the original 150 women, 10 were renamed as contacts to men suffering with gonorrhea during the study period, and examination of these women showed 4 to be positive and 6 negative for gonorrhea.

In a study undertaken February through June 1955, it was ascertained that 15 percent of all female contacts were renamed by men with a diagnosis of gonorrhea during a period of 60 days following initial identification of the women as contacts. A similar study conducted February through March 1956, after the introduction of benzathine penicillin G for the treatment of gonorrhea in women, showed that 6.7 percent of contacts named (10 in 150) were renamed. This is a significant reduction, and we feel it is due entirely to the change in therapy.

There has also been a reduction in the number of men entering the clinic and diagnosed as having gonorrhea during the period January 1-May 25, 1956. The accompanying table shows this reduction to be the first of any magnitude since accurate records were kept, beginning March 16, 1953. It is true that this reduction has occurred only for a very short period but we have reason to believe, because

of the downward incidence of gonorrhea week by week until the day of the writing of this paper, that it will continue.

## Gonorrheal infections in males treated in Memphis and Shelby County Health Department, January 1954-May 1956

Month	1954	1955	1956
January.....	230	295	<sup>1</sup> 215
February.....	227	224	210
March.....	265	303	266
April.....	223	202	<sup>2</sup> 193
May.....	274	246	209
Subtotal (5 months).....	1, 219	1, 270	1, 083
June.....	348	370	-----
July.....	275	280	-----
August.....	319	339	-----
September.....	329	377	-----
October.....	240	217	-----
November.....	218	187	-----
December.....	261	251	-----
Total (12 months).....	3, 209	3, 291	-----

<sup>1</sup> Beginning January 1, 1956, female contacts were treated with 600,000 units PAM and 1.2 million units Bicillin.

<sup>2</sup> Beginning April 1, 1956, males were treated with 600,000 units PAM and 1.2 million units Bicillin.

The addition of long-acting penicillin in the treatment of gonorrhea seems to have started a reduction in incidence of the disease in the venereal disease clinic of the Memphis and Shelby County Health Department. It is believed, however, that without the "speed zone" epidemiology technique a change in therapy alone would be ineffective. It is equally obvious that this technique alone over a 3-year period has in itself been equally ineffective. A combination of the two is necessary for success in the reduction of the incidence of gonorrheal infection in the community.

## Conclusions

Speed zone epidemiology in itself is not adequate to control gonorrhea.

The addition of a long-acting antibiotic reduces the number of women reinfected and renamed as contacts within 60 days.

The addition of a long-acting antibiotic as a therapeutic agent reduces the incidence of gonorrhea in men.

# Speed Zone Epidemiology: A Preliminary Report On Benzathine Penicillin G For Gonorrhea in Women

By CARL E. HOOKINGS, M.D., D.P.H.,  
and L. M. GRAVES, M.D.

SINCE the discovery by Neisser of the role of the gonococcus in gonorrheal infections, efforts have been made to prevent the spread of this organism from one person to another. With the advent of penicillin in 1944, it was hoped that gonorrhea would be rapidly controlled, but this hope has not been realized. Since there has never been any difficulty in effecting cures in men no matter what type of penicillin has been used, one is led to believe that the reason for continued high rates is that infection in women is either undetected, inadequately treated, or both.

The Venereal Disease Control Clinic in the Memphis and Shelby County Health Department on March 16, 1953, set up a "speed zone" epidemiology program. In speed zone epidemiology all male patients are interviewed for the names of contacts and an effort is made to bring these contacts to examination and treatment within 72 hours.

The results of this program have been disappointing. Between March 16, 1953, and March 16, 1956, 9,835 men were admitted to the clinic. They named as contacts 15,410 women, of whom 12,921 were within the jurisdiction of the health department. Of these 12,921 women, 83.5 percent have been brought to examination and

treated either as infected patients or as possibly incubating contacts. In the first year of the "speed zone" epidemiology program, 3,229 men with gonorrhea reported to the clinic; in the second year, 3,397; in the third year, 3,209. The contact index remained at the 1.5 level over the 3 years. We have felt that our failure to reduce the incidence of gonorrhea has been due to our inability to control the disease in women.

Should a woman have sexual intercourse with a man within 24 hours following her treatment, it is conceivable that he may contract gonorrhea and, though he name her as the contact, she may be found to be free of the disease. Such an infection has nothing to do with the adequacy of therapy; at the time of contact the penicillin had not yet killed the gonococci. Apparently the sex activity of certain patients is such that the therapeutic agent does not have the opportunity to act long enough to prevent the woman from contracting the infection herself or from giving the residual infection to her partner.

The present study was undertaken to determine whether therapy has been adequate and whether other therapy might be more effective. Therapy had consisted of 600,000 units of procaine penicillin with aluminum monostearate (PAM) to each female patient plus the advice to take vinegar douches and to refrain from sexual intercourse and indulgence in alcohol for at least a week. Abstinence from alcohol was intended to increase resistance to infection and to sexual impulses. We decided to determine whether the addition of 1.2 million units of benzathine penicillin G (Bicillin) with a consequent longer lasting blood level of penicillin would improve the female patient's chance of bacteriological cure and reduce the incidence of repeat visits by female contacts. (Benzathine penicillin G was supplied by Wyeth Laboratories under the trade name Bicillin.)

During this study, 150 women, named as contacts, were admitted to the Memphis and Shelby County Health Department Clinic and cervical and urethral smears were taken. All of these women were given 600,000 units of PAM and 1.2 million units of benzathine penicillin G and

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on prescription on a large scale in England and Wales as was revealed by two analyses. Dunlop and associates examined 17,301 prescriptions covering the month of September 1949 and found that 1,636 or 9.4 percent were for barbiturates. In an analysis made by the Ministry of Health of 106,295 prescriptions issued during October 1954, 8.8 percent were for barbiturates or preparations containing barbiturates. The percentage of all prescriptions in which barbiturates were the sole or principal agent in 1954 was 6.4 percent. It is apparent that these highly useful drugs are widely used.

### Misuse of Barbiturates

In any consideration of misuse it is necessary at the outset to examine assertions concerning their allegedly promiscuous use. Parenthetically, it should be stated that consideration of promiscuous use at this point is restricted to usage of barbiturates at their usual hypnotic or sedative level; usage of them in excessive doses will be considered separately. By promiscuous use is meant their unrestricted, indiscriminate use when they are unnecessary, ill-advised, or contraindicated. It carries the connotation of misuse.

The allegation concerning barbiturates is twofold. It has been charged that the public is obtaining barbiturates illegally and taking them without advice of a physician; and that some physicians are prescribing barbiturates irresponsibly. The argument is based in part upon the increasing annual production of barbiturates and the calculated per capita consumption of them. Taken alone this is scarcely a reliable argument. For an increase in consumption is not necessarily *prima facie* evidence of misuse. It has already been noted that pharmaceutical manufacturers increasingly have incorporated small sedative doses of barbiturates in mixed preparations.

As for the allegation against physicians, it is the opinion of Fazekas and Koppanyi that the great volume and proportion of legally prescribed barbiturate preparations are mainly responsible for the widespread belief

that barbiturates are used promiscuously in therapeutics. From their study on whether barbiturates were being promiscuously prescribed, they concluded that physicians were using barbiturates for disturbed states because there was no specific or an equally good therapeutic product available. In the opinion of these investigators, the physicians were using the barbiturates rationally and with full knowledge of the limitations; and they were waiting only for the advancement of medical science to provide an effective therapeutic alternative or preferably replacement. Fazekas and Koppanyi predicted that if physicians had "at their disposal truly etiotropic drugs for anxiety and tension states, they would certainly not prescribe barbiturates."

The wide prevalence of psychiatric complaints among the population must add up to a large volume of legitimate therapeutic need. In applying the proper rationale to meet this need physicians have little latitude of choice. Prescriptions of barbiturates to meet this need would not per se be promiscuous. Rather, it would be a discharge of inescapable responsibility with the most effective therapy available.

### Categories of Misuse

Like many things of value, barbiturates are undoubtedly misused. When there is use in excessive amounts and overdosage or in conjunction with alcohol, that indubitably is misuse. This misuse falls into five categories according to attendant circumstances.

The first type of misuse is prolonged use of barbiturates in slightly excessive amounts. Some individuals may be of such unstable personality as to rely upon barbiturates to enable them to face the real or fancied tension of their daily lives. Thus, because barbiturates afford relief from anxiety, tension, and conflicts, they lend themselves to habitual self-medication at a slightly increased dosage, particularly in disturbed states for which there is no specific therapy.

Second, barbiturates may be misused as a substitute for narcotics or

alcohol. Narcotic addicts who are temporarily unable to obtain the narcotic of their choice may turn to barbiturates. Alcoholics may resort to barbiturates to relieve the tremor and nervousness following a drinking episode. Another variety of misuse in this category is the ingestion of barbiturates following drinking of alcohol; or vice versa. Large doses of barbiturates may be taken inadvertently during a period of alcoholic intoxication. Then too, some individuals deliberately combine alcohol and barbiturates to obtain a brief but intense exhilaration, which is of course followed by profound intoxication and narcosis. This is a highly dangerous practice; for, as pharmacologists have repeatedly warned, these drugs in combination have a potentiating action which magnifies the effects of each.

The remaining three categories have to do with episodes of overdosage of barbiturates which occur either accidentally or intentionally. A person who wants only to obtain rest during a period of extreme stress may take an excessive amount of a barbiturate. Usually he is seeking a quick and full effect; he wants to make sure that he will fall into a deep sleep without delay. Perhaps he subscribes to the old adage that if a little is good, a lot is better. At the same time he is unfamiliar with the dangers of barbiturates. As a result he may increase the dosage and consume a quantity far in excess of that required to produce a night's sleep.

More frequently an unintentional overdose occurs because a person ingests additional doses after failure of the usual hypnotic dose to produce sleep. After a person takes one or two sleeping pills, he may enter into a twilight zone of mental confusion and forgetfulness instead of dropping off to sleep. In this state he forgets that he has already taken the pills; he takes more. Thus, he accidentally ingests excessive amounts of barbiturate while he is in a semi-stuporous state induced by the original dose. This sequence is known as automatism.

In addition to these episodes of overdosage which are purely ac-

## Report on Barbiturates

CURRENTLY there is a clamor and outcry in the press about the widespread misuse of barbiturates with reports of accidental deaths and demands that these drugs be placed under strict control. This is not a new complaint. It was in response to just such a note of alarm that 13 years ago the Committee on Public Health of The New York Academy of Medicine first deliberated on the value of barbiturates, the dangers of their misuse, and proper measures for their control. Two years later it formulated a code that set the pattern of control, a pattern that has been widely adopted. Now a rising chorus of protest over the existing situation has prompted the committee to reexamine the problem of barbiturates.

### Definition

The barbiturates comprise a family of many chemical compounds of which barbituric acid is the parent. Some 33 years ago one of the derivatives was introduced into therapy under the name of veronal. Since then by substitution of an aliphatic or aromatic group, barbituric acid has yielded a large number of derivatives. Many have proved to be therapeutically useful.

Each of these has a chemical name; in addition, it has either a popular name or a registered trade name. Since barbiturates are members of a series, all have essentially the same pharmacological and therapeutic action, but each shows an individuality. Hence, there are preparations containing two or more barbiturate derivatives; each such mixture is usually marketed under a registered proprietary name. Furthermore, pharmaceutical manufacturers have added a small amount of barbiturates to mixed preparations in which they are not the main ingredient. It is said that the number of products containing barbiturates, including single, multiple, and mixed ingredients, now exceeds 275.

### Use of Barbiturates

The therapeutic uses of the barbiturates are several: hypnotic, sedative, anticonvulsant, anesthetic, and adjuvant with analgesics. Thus, one or more of these substances is the active principle in sleeping pills and in some of the tension-reducing preparations. They are, however, not to be confused with the newer so-called tranquilizing drugs such as rauwolfia or chlorpromazine. (Some of the newer tranquilizing drugs

which are growing in popularity as substitutes for the barbiturates may have similar hazardous effects. They have not been considered in this report because their use is as yet too brief to warrant an authoritative statement.) The barbiturates are also an almost indispensable therapeutic agent for the control of convulsions in epilepsy. Each drug in the barbiturate group is marketed and dispensed as an individual preparation; some are included in multi-ingredient prescriptions and products. As a group the barbiturates are rated among the 10 most valuable drugs available to physicians.

Their value is reflected in the extent of their use. In view of their properties it is perhaps not too surprising that the production and sale figures are very high. The total national production of barbiturates has shown a steady increase since World War II. In addition to their increased use as hypnotics, it is believed that pharmaceutical manufacturers more and more are incorporating small sedative doses of barbiturates in mixed preparations. Idestrom states that in the United States in 1948 the estimated consumption was 336 tons or 24 doses of 0.10 gm. per person as compared with an estimated consumption in 1952 in Sweden of 20 tons or 29 doses of 0.10 gm. per person.

From a study in 1954, Fazekas and Koppányi assert that between 3 and 4 billion doses of barbiturates are legally prescribed by the medical profession in the United States annually. Assistant Commissioner Trichter of the New York City Health Department estimates that 12 percent of all prescriptions compounded by pharmacists in this city contain one or another of the barbiturates. They are also dispensed

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In view of the national interest in commerce in barbiturates, Public Health Reports reprints from the June 1956 Bulletin of The New York Academy of Medicine the report of its Committee on Public Health. The report was prepared by the Subcommittee on Barbiturates: Haven Emerson, M.D., chairman, Henry Aranow, Jr., M.D., George Baehr, M.D., McKen Cattel, M.D., Hubert S. Howe, M.D., Lawrence C. Kolb, M.D., Robert W. Laidlaw, M.D., J. Murray Steele, M.D., H. D. Kiuse, M.D., secretary. It was approved by Edward J. Donovan, M.D., president of the academy.

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effects. Only low grade tolerance is developed under such circumstances; therefore the tendency to increase dosage to obtain adequate effects is minimal. This is a sharp point of distinction between barbiturates and opiates. Although psychic dependence on these substances may develop, it is believed not to be injurious. It is like habituation to coffee or tobacco. From these observations it is the belief of the Committee on Public Health that the habitual daily use of barbiturates at therapeutic levels, even for long periods, is not perforce injurious. It should not be necessary to add that this pronouncement does not connote approval of or condone the use of barbiturates for whatever length of time without valid reason and medical supervision.

Like almost every form of medication, barbiturates when misused are capable of producing toxic effects and even death. Through regular, prolonged use of barbiturates in excessive amounts chronic intoxication develops. The symptoms of this toxic cumulative action are mainly mental, psychic, and neurological. Specifically, these manifestations are: muscular incoordination, slurred speech, inability to perform skilled acts, as well as mental symptoms, such as confusion, abnormal behavior, impaired judgment, and possibly hallucinations.

Acute intoxication results from an overdose, either accidental or suicidal, on a single occasion. It may be mild, moderate, or severe in degree depending upon whether the person remains conscious, or becomes semicomatose, or comatose. Mental and neurological disturbances are the principal symptoms. In the severe form unless prompt and energetic therapeutic measures are instituted, the outcome may be fatal. The degree of intoxication and the issue depend on the type of barbiturate, the dosage, and the patient's constitution and physical status.

### *Prevalence of Misuse*

It is difficult to derive accurate figures on the total prevalence of misuse of barbiturates because data in one or more categories are un-

trustworthy or unobtainable. For example, the general public seems to be familiar with the sedative and somnifacient effects of barbiturates; but no one can state reliably how many persons are obtaining barbiturates illegally and taking them in the usual or slightly higher sedative or hypnotic dose without medical supervision. (Where rates are reported, they are based on per million population, total, male, or female.)

*Addiction.* Reliable data indicating the extent of true addiction, that is, prolonged daily ingestion of very large quantities of barbiturates, are not available. Despite the total quantity of barbiturates used, the figure for addiction is believed to be insignificant; for, addicts are not frequently encountered. Addiction is probably limited to persons who, if the barbiturates were not available, would take excessive quantities of alcohol or other drugs.

Of 919 barbiturate poisonings in New York City in 1954, 36 were said to be in barbiturate addicts.

*Poisonings.* Due to inadequate report procedures the prevalence of chronic poisoning is not known. Data are therefore exclusively on acute poisonings. These may be conveniently classified under the headings nonfatal and fatal.

*Nonfatal poisonings.* Not all cases of barbiturate poisoning are fatal. The nonfatal cases may require treatment in a hospital. It is reported that in England and Wales the number of cases requiring hospital treatment has increased in recent years. In the United States about one-fifth of all instances of drug poisoning are due to barbiturates. It is estimated that 1 in every 2,000 admissions to hospitals is for acute barbiturate poisoning.

Figures on the incidence of nonfatal poisonings in New York City since 1945 are available by years. Under article 7, section 86 of the Sanitary Code of New York City it is the duty of persons in charge of hospitals and of physicians to report poisoning, whether acute or chronic, by drugs due to self-medication or on prescription. The nonfatal poisonings are reported to the

bureau of preventable diseases of the New York City Department of Health and from there to the poison center of the department. The rate of total nonfatal poisonings, including both categories, has risen steadily in New York City from 1945 to 1954. Indeed, it has more than doubled over that period. The rate was 35.4 for 1945; it reached 61 in 1948; and became 97 in 1954.

Nonfatal poisonings comprise two categories: poisonings under accidental or undetermined circumstances, and unsuccessful suicidal attempts. Locket and Angus, reviewing 64 consecutive cases entering Oldchurch Hospital in England in the 4 preceding years, found that 49 at least were suicidal attempts. Moreover, of all cases of attempted suicide admitted alive during the 4 years, barbiturates were the chosen agents in more than 80 percent.

Analysis of the rates of nonfatal poisonings in New York City between 1945-54 reveals that unsuccessful suicidal attempts constituted the major category every year, sometimes by a ratio of 2:1. The rate for attempted suicide was 22.4 per million living population in 1945; it became 42 in 1948; it rose to 58 in 1950; it dropped to 37 in 1952; and returned to 57 in 1954. In contrast, the rate for accidental and undetermined nonfatal poisonings did not exceed 20 per million population until 1949; it became 30 in 1953; and 40 in 1954. It is apparent that the rate of total nonfatal poisonings has increased and that unsuccessful suicidal attempts contribute the major portion.

*Fatal poisonings—total deaths.* The data on deaths from barbiturate poisoning are much more reliable than those on morbidity. Figures are available for England and Wales, the United States, and New York City.

For England and Wales the rate of total deaths from barbiturate poisonings was 1.26 in 1939, and remained between the range of 1.7 to 2 until 1945 when it became 2.5. Thereafter it has increased steadily to become 13 in 1954 (fig. 1). If the 5-year period from 1939-43 is compared with a later period of similar

cidental or inadvertent, in others the intent is suicide. Hence, barbiturates are misused as a means of self-destruction. Indeed, they are a popular choice. Yet judged by their relative effectiveness, it is a less perfect choice for the purpose than numerous other methods. Nevertheless, it represents the gravest misuse of these valuable drugs.

In sum, whatever the motive and attendant circumstances, persons may increase the amount of barbiturate ingested to the point where an episode of acute poisoning occurs. Not infrequently it terminates fatally.

### *Effects of Misuse*

The effects of misuse of barbiturates may be considered under three headings: habituation and addiction; chronic intoxication; acute poisoning. Because barbiturates afford relief from anxiety, tension and conflicts, they lend themselves to habitual use, especially since there is no specific therapy to supersede them. There is a difference of informed opinion as to whether they should be termed addicting or habituating drugs. It may be helpful to consider a definition of terms.

To most laymen the word "addiction" simply means a bad habit. To experts it means more than that, but they differ on its definition. According to pharmacologists the significant element in addiction is dependence, either physical or emotional. Tatum and Seever have defined addiction as "a condition developed through the effects of repeated actions of a drug such that its use becomes necessary and cessation of its action causes mental or physical disturbances." However, Isbell and Fraser do not regard this definition as acceptable to physicians and social workers who have to handle addicts. They state that the concern about addiction is "not because individuals who use drugs become dependent but because the effects of the drug are harmful both to the individual and society." This view is reflected in Vogel, Isbell, and Chapman's definition of drug addiction "as a state in which a person has lost the power of self control with reference to a

drug and abuses the drug to such an extent that the person or society is harmed."

In their review of the subject, Isbell and Fraser state that the Drug Addiction Committee of the National Research Council reached a definition of drug addiction which represents a compromise between a formulation based on dependence and that based on harm to the individual or society. It is: "Addiction is a state of periodic or chronic intoxication, detrimental to the individual and to society, produced by the repeated administration of a drug. Its characteristics are a compulsion to continue taking the drug and to increase the dose with the development of psychic and, sometimes, physical dependence on the drug's effects. Finally, the development of means to continue the administration of the drug becomes an important motive in the addict's existence."

Isbell and Fraser then point out that physical dependence is not an essential part of this definition; and that psychic dependence, although a necessary, is not a specific and distinctive characteristic. In their opinion the latter adds nothing to the definition. They express their preference to return to their original position in defining addiction "as a state of periodic or chronic intoxication in which an individual compulsively abuses a drug to such an extent that the individual or society is harmed."

While agreeing that an addicting drug produces harm to an individual or society, the committee would place emphasis on dependence and, for purposes of differentiation, particularly on physical dependence. Perhaps the best way to understand addiction is to distinguish it from "habituation." "Habituation," so far as the use of drugs is concerned, signifies an emotional dependence resulting from repeated use; administration of the drug may be discontinued without disturbance of bodily functions. In contrast, "addiction" is considered to be an altered condition of the cells, tissues, and organs of the body, brought about by the continuous administration of a drug; cessation of use causes painful physi-

cal as well as mental disturbances. In brief, habituation refers to the condition in which psychological stress appears upon abstinence; while addiction pertains to the condition in which physical signs also occur upon withdrawal.

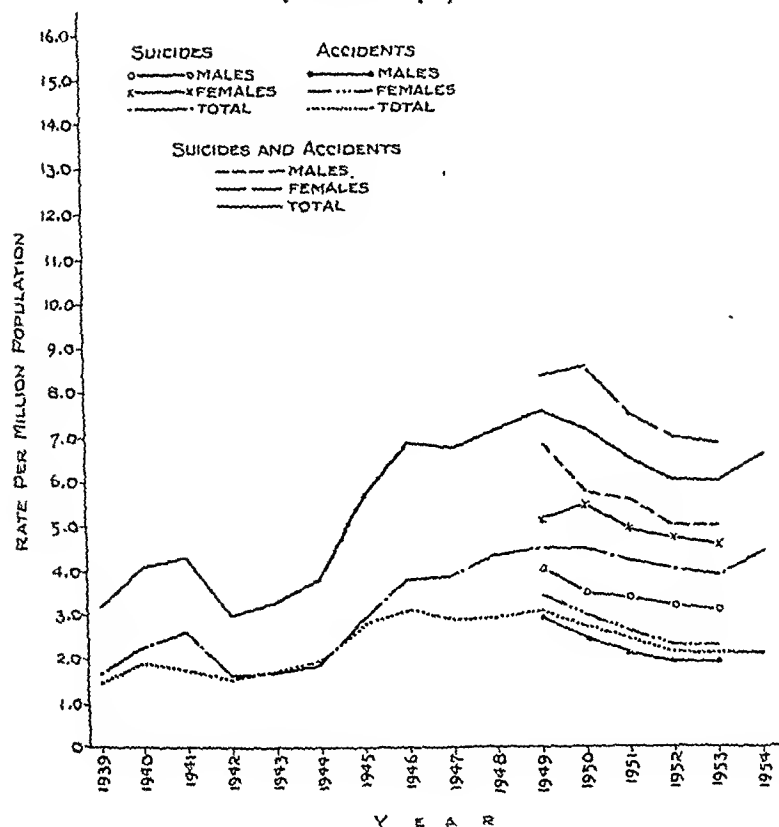
Vogel, Isbell, and Chapman assert that barbiturates fulfill all three criteria of addiction: development of tolerance, habituation, and physical dependence. They report that when barbiturates are withdrawn abruptly from patients who have been taking 12 gr. or more daily for several weeks, convulsions and acute psychotic reactions appear. From these results they are emphatic in declaring that the derivatives of barbituric acid are addiction-producing drugs since they can bring about not only psychological but also physical dependence. It would appear therefore that physical withdrawal symptoms occur when large amounts of barbiturates have been ingested over a period of time. Under these conditions it is probably accurate to refer to barbiturate addiction.

The Expert Committee of the World Health Organization, after considering the problem, concluded "that the barbiturates must be considered drugs liable to produce addiction, [and] dangerous to public health, although differentiation among them with respect to the intensity of this liability cannot be made at this time."

After weighing all the evidence it is the opinion of the Committee on Public Health that true addiction manifested by physical dependence with withdrawal symptoms may follow prolonged high dosage of barbiturates. But, the committee emphasizes that the symptoms of addiction with barbiturates are produced only under these specific conditions; and that these conditions do not commonly occur.

Of equal if not greater concern is the question relating to potential dangers of prolonged ingestion of barbiturates in small amounts. It may be pointed out that the habitual daily use of small or moderate doses of barbiturates under medical supervision has been continued for many years without evidence of harmful

Figure 2. Deaths from barbiturates in the United States, 1939-54, rate per million population.



United States, 1.65 to 2.27; New York City, 3.1 to 8.2. It may be seen that in England and Wales the rate increased almost fivefold; in the United States,  $1\frac{1}{2}$  times; and in New York City,  $2\frac{1}{4}$  times.

Comparing the three sources of data over the years 1939 through 1954 the rates were highest in New York City (fig. 4). Up to 1950 the rates were higher and thereafter lower for the United States than for England and Wales.

The sex distribution of rates for fatal barbiturate poisoning under accidental circumstances in the data of England and Wales shows a higher figure for females for all except 4 of the 16 years (fig. 1). In 1939 the rate was 0.2 for males, 0.5 for females; in 1954, 3.2 for males and 5.1 for females. The average rates for the period 1949-53 were: male, 2.5; female, 3.3. During that period in the United States the rates for both sexes declined (fig. 2). In 1949 they

were 2.9 for males and 3.4 for females; in 1953 they were 1.9 for males and 2.3 for females.

For New York City from 1939 through 1943, the rate for males fluctuated narrowly between 2.5 and 3; it became 6.0 in 1944, and from 1946 through 1953 it was within the range 7.7 to 9 except for 1950 when it was 11 and 1952 when it was 11.5 (fig. 3). The rate for females from 1939 through 1953 had a general trend upward but it fluctuated with peaks at several points. From 1939 through 1941 it did not exceed 2.9; over the next 3 years it ranged between 4.4 and 5.4; it had peaks of 11.8 in 1946, 9.1 in 1950, and 12.5 in 1952; then dropped to 8.4 in 1953. The male rate was in excess of the female rate for 10 of the 16 years, but the course was irregular. The averages for the period 1949 to 1953 were: male, 9.5; female, 8.6.

From 1918 to 1930 accidental and undetermined fatal poisonings from

morphine exceeded in absolute numbers those from barbiturates. After that period a reversal in the ratio occurred. For example, in 1922 the ratio was 5:1 with morphine predominant. In 1954 the ratio was likewise 5:1 but barbiturates were predominant.

*Deaths from suicide by barbiturates.* In England-Wales during the period from 1939 through 1954, the suicide rate by all methods tended to fluctuate within a narrow range without showing a definite upward or downward trend. The rate for suicide from barbiturate poisoning, however, after having remained fairly uniform up to 1945, then underwent a rapid rise (fig. 1). Starting at 1 in 1939, the rate became 1.4 in 1945 and reached 8.8 in 1954. If the 5-year period from 1939 through 1943 be compared with a later period of similar length, 1950 through 1954, the average rate of deaths by suicide increased sevenfold, from 1 to 7.1 per million.

In the United States the suicide rate from barbiturate poisoning fluctuated from 1.6 to 2.6 from 1939 to 1944, inclusive; thereafter it rose steadily to reach a level of 4.5 during 1949 and 1950; it declined slightly during the next 3 years and then moved upward to 4.4 in 1954 (fig. 2). The average rate for 1950-54 was double that for 1939-43; 4.2 compared with 2.

In New York City from 1939 through 1943, the rate for suicide by barbiturate fluctuated narrowly between 3.2 and 5; it jumped to 12 in 1944 and moved rather unevenly to reach 22.8 in 1954 (fig. 3). The average rate for 1950 through 1954 was almost 4 times that for 1939 through 1943; 16.1 as against 4.3 per million.

Upon comparing the three sources of data over the 16-year period 1939 through 1954, the rates are found to be in the following ascending order: the United States, England-Wales, New York City (fig. 4). For the last 5 years of that period the average rate for England-Wales has been 1.7 times that for the United States; that for New York City has been 2.2 times that for England-Wales and 3.8 times that for the

length, 1950-54, the average rate of fatal poisonings during the latter shows a sixfold increase, 1.8 versus 10.5.

In the United States the rate for total deaths from barbiturate poisoning was 3.23 in 1939, and remained in a range not exceeding 4.3 until 1945 when the rate was 5.7. It reached 7.6 in 1949; thereafter it declined and has remained between 6 and 6.5 from 1951 through 1954 (fig. 2). If the average rates for two 5-year periods are compared, 1939-43 and 1950-54, it is found that the figure for the later period is slightly less than twice as high, 3.6 versus 6.5.

For New York City the rate was 5.7 in 1939; it gradually increased to 9 in 1943; it jumped to 17.7 in 1944; it reached 27.3 in 1950; it declined slightly over the next 3 years; and then rose to 25.9 in 1954 (fig. 3). The average rate for the period 1950-54 was 24.3; it was 3 times

higher than the average rate of 7.4 for the earlier span, 1939-43.

Comparison of the three sources of data reveals that the rate for total deaths from barbiturate poisoning was higher in New York City for every year from 1939 through 1954 than were the rates for either England-Wales or the United States (fig. 4). From 1939 to 1949 the rate for the United States was higher than that for England-Wales. Thereafter the reverse was true. For 1954 the rate for England-Wales was about twice as high as that for the United States. The comparative order of average rates for 1950-54 was: United States 6.5; England and Wales 10.5; New York City 24.3.

For both males and females in England and Wales the rate of fatal poisonings has risen steadily from 1939 through 1954 (fig. 1). Except for one year, the rates for females were slightly higher. The average rates for the period 1949-53 were:

male, 8.1; female, 10.2. Figures on the distribution of fatal poisonings by sex in the United States are available only from 1949 through 1953. During that period the rates for both sexes declined; the rates for females were slightly higher than for males (fig. 2). The average rates were: male, 5.7; female, 7.7.

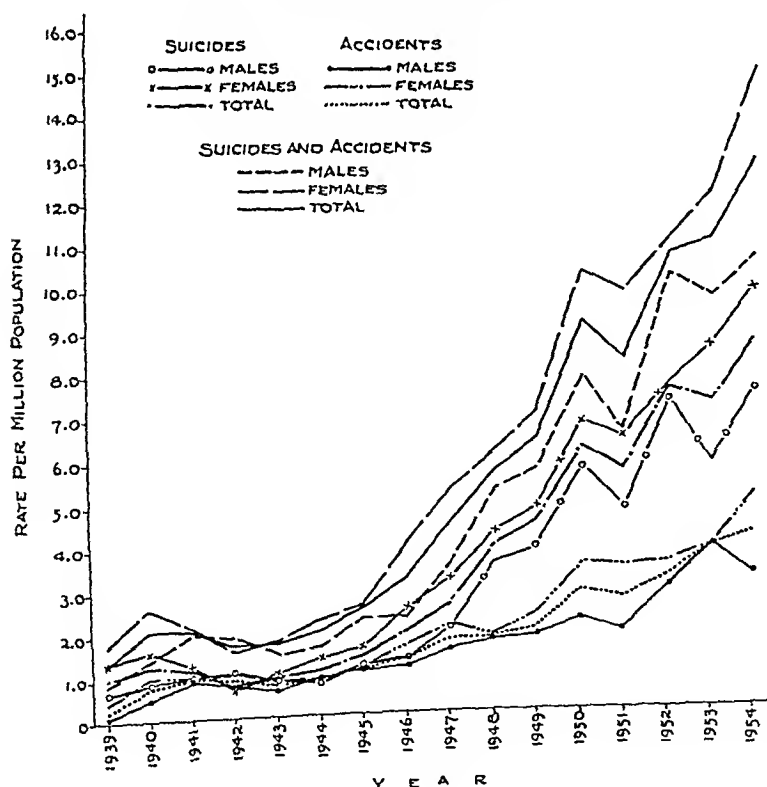
Until 1944 the rate for fatal poisonings for males in New York City ranged between 6 and 7.7; in 1944 it jumped to 17; in 1950 it reached a high point of 27.7; and declined thereafter to a value of 23 in 1953 (fig. 3). The rate for females was 5.3 in 1939 and increased steadily until it reached 10.7 in 1942; it jumped to 18.4 in 1944; and reached its peak of 31.3 in 1946. For the next 7 years it fluctuated rather narrowly between 20.3 and 23.1 except for the year 1950 when it was 27. Up to 1948 the female rate was higher than the male but thereafter the male has been higher. The average rates for the 5-year period 1949 through 1953 were: male, 24.4; female, 23.2.

Fatal poisonings comprise two categories: death under accidental or undetermined circumstances and suicide.

*Death under accidental circumstances.* For England and Wales the rate for accidental death from barbiturate poisonings was 0.3 in 1939, and rose gradually to become 4.1 in 1954 (fig. 1). For the United States the rate for fatal barbiturate poisonings under accidental circumstances was 1.5 in 1939; it remained at approximately that level until 1945 when it reached 2.8; its high point was in 1949 with a rate of 3.1. In 1951 it declined and from 1952 to 1954 it was 2.1 (fig. 2).

The trend of rates for New York City over the same period has been highly irregular (fig. 3). The rate for fatal poisonings under accidental circumstances was 2.4 in 1939; it reached three peaks of 10.1, 10, and 12 in 1943, 1950, and 1952 respectively; and then dropped precipitately to 3.1 in 1954. For each of the three census areas the average rate of the period 1939-43 compares with that of 1950-54 as follows: England and Wales, 0.74 to 3.34;

Figure 1. Deaths from barbiturates in England and Wales, 1939-54, rate per million population.



fatal and nonfatal, from 1945 to 1954 inclusive. It is found that the rate was 57.6 in 1945; it increased steadily until it reached 111.1 in 1950; for the next 3 years it was below 100; but in 1954 it reached the peak of 123.3 per million living persons. The rate for 1954 was more than twice that of 1945. Of 491 cases of harbiturate poisoning in

New York City studied by occupation, 40 percent were in housewives, theatrical performers, clerks, unemployed and factory workers with housewives leading all others combined in this group by almost 2 : 1.

The total rate may be separated into two categories: nonfatal and fatal poisonings under accidental and undetermined circumstances; attempted suicide and suicide. It is interesting to examine the composition of this total rate to ascertain the trend and proportion of each component.

*Nonfatal and fatal poisonings under accidental circumstances.* Barbiturate poisonings under accidental circumstances, both nonfatal and fatal, in New York City have shown an upward trend with some fluctuation over the 10-year period 1945-54. The rate in 1945 was 21.4; in 1954, 43.4. Thus, over this span the rate has more than doubled.

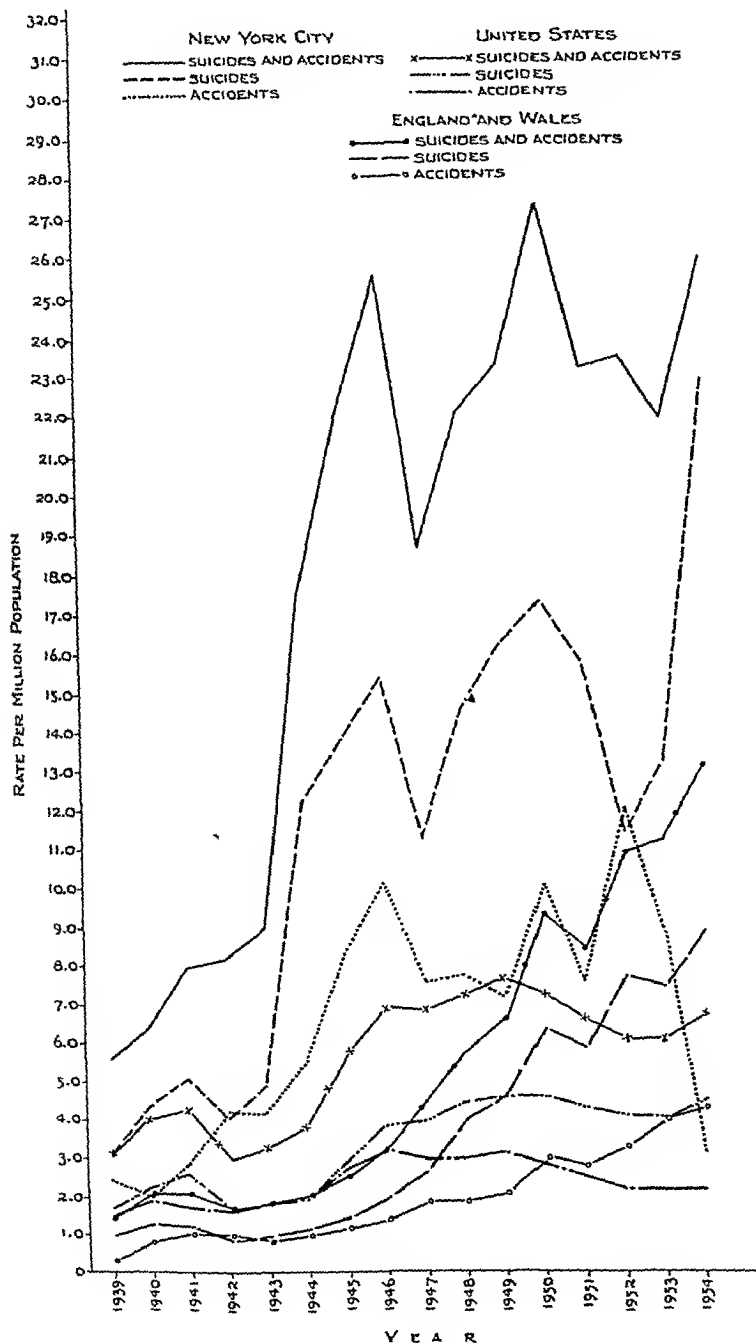
*Attempted suicide and suicide.* The rate for attempted suicide and suicide from barbiturate poisoning in New York City was 36.2 in 1945; it increased steadily to reach 75.7 in 1950; it declined during the next 2 years; and then resumed its climb to reach 79.8 in 1954. Here again the rate over the 10-year span has more than doubled.

For every year from 1945 through 1954, the rate for combined suicidal attempts and suicide was greater than that for combined nonfatal and fatal poisonings under accidental circumstances. In four of the years the rate was more than twice as high for attempted suicide and suicide than it was for poisonings under accidental circumstances. Over the 5-year period, 1950-54, almost two-thirds of the barbiturate poisonings, both fatal and nonfatal, were by self-destructive intent rather than by accident.

### Source of Supply

It is abundantly clear that there has been an increase in the use of barbiturates; it is equally apparent that it has been accompanied by an increase in the misuse of them. But there is sharp difference of opinion over the source of supply which contributed to the misuse. It is con-

Figure 4. Deaths from barbiturates in New York City, United States, and England and Wales, 1939-54, rate per million population.



United States. In 1939 Hambourger noted that in the United States the incidence of suicides was nearly twice as high in large cities as in the whole Nation.

The sex distribution on the suicide

rate by barbiturate poisoning for England-Wales shows that for the period 1939-54 the rates for female suicides have with the exception of 1 year been higher than those for the males. The average rates from 1949

through 1953 were: males, 5.6; females, 6.9. Contrastingly, when total suicide rates by all methods are considered, the male rates have been consistently in excess of the female. From 1949 through 1953 in the United States the rates for barbiturate suicides for the females were consistently slightly higher than for the males. The averages were: males, 3.4; females, 5. The distribution by sex of the suicide rate from barbiturate poisoning in New York City from 1939 through 1953 does not show a consistent trend. The averages for the period 1949 to 1953 were: male, 14.9; female, 14.6.

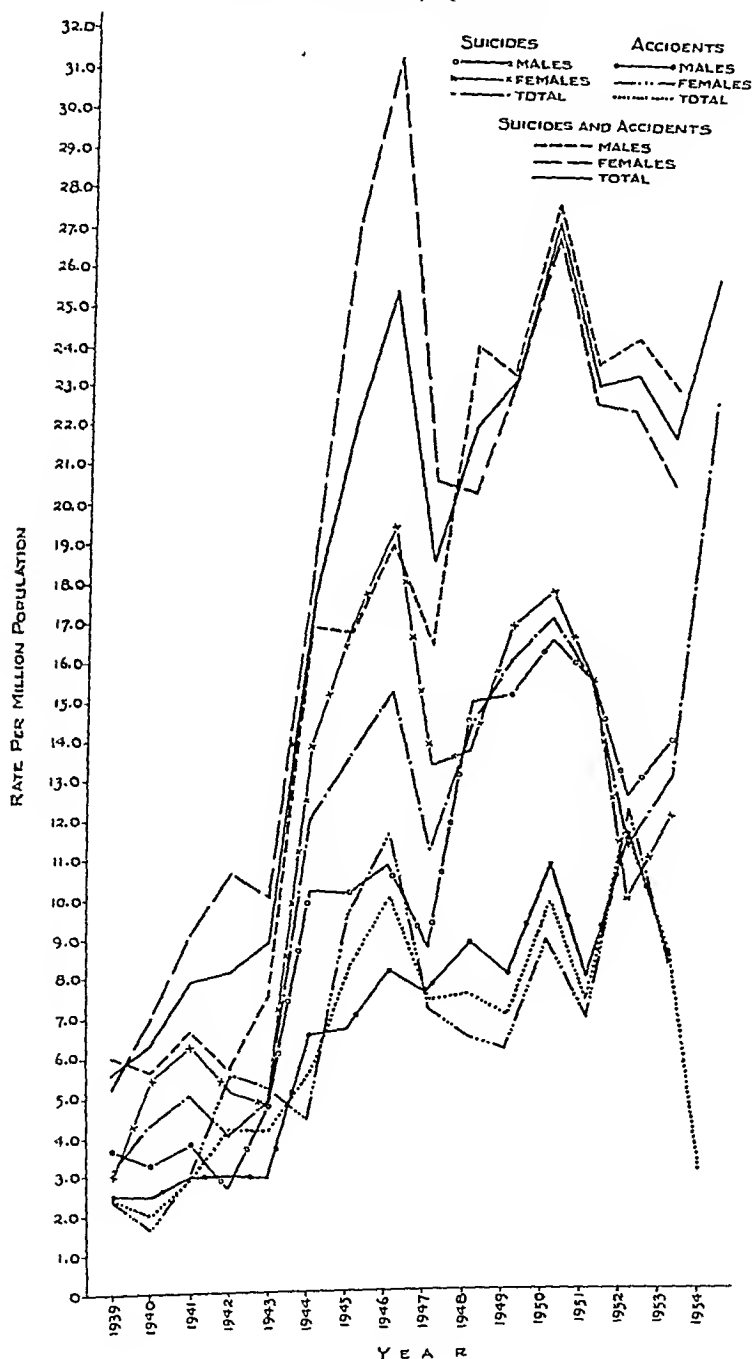
From a study of the England-Wales data Brooke found that the increase in suicide rates from barbiturate poisoning from 1942 to 1954, inclusive, was more pronounced at ages 45 and upwards. In the age group 45-64 the rates for 3 years by sexes were: 1942, males, 1.6, females, 1.5; 1948, males, 7.3, females, 8.6; 1954, males, 14.9, females, 18.1. The rates in the age group 65 and over were: 1942, males, 0.6, females, 0.4; 1948, males, 5.1, females, 6.3; 1954, males, 12.8, females, 24.4. It was remarked that it was in these age groups that one would expect to find most of the cases of depression and insomnia for which barbiturates might be prescribed.

The distribution of the death rate from barbiturate poisoning on the basis of attending circumstances yields striking results. Of the average death rates from barbiturate poisoning during 1950 to 1954, inclusive, in England and Wales, the United States, and New York City, the percentages due to suicide were respectively: 67.6, 61.6, and 66.2. Thus in all three areas suicides account for about two-thirds of the deaths from barbiturate poisoning.

From the England-Wales experience, Brooke commented that a preference has been shown lately for using barbiturates as suicidal agents rather than some other lethal means. This is likewise true in New York City where of recent years barbiturates have become the method of choice for suicide.

Total poisonings, nonfatal and fatal. From the data on total poisonings in New York City, both

Figure 3. Deaths from barbiturates in New York City, 1939-54, rate per million population.





the retail pharmacist is said to dispense barbiturates without a prescription. Where there are legal provisions which require the pharmacist to keep records on the purchase and distribution of barbiturates, these violations are detectable and subject to prosecution. However, the inadequacy of enforcement even in these areas makes the figures on violations extremely unreliable.

The second source of supply without a prescription is from friends and neighbors who usually act from a motive of helpfulness. When a person complains of insomnia or anxiety, a well-intentioned friend with a similar complaint may provide barbiturates out of his supply.

The third source of supply of barbiturates, it is asserted, is illegal traffic with a black market. By some this is regarded to be the major source of supply of barbiturates and responsible for most of the potentialities of misuse. It is alleged to be a vast, gigantic operation. In an article on the subject the *New York World-Telegram and Sun* detailed the four channels which operate outside the usual pharmaceutical routes. First in the illicit trade are export-import firms which obtain their supply from the wholesale druggist. All that the export-import firm needs is a letterhead and a telephone number; for these may be the only credentials on which the wholesaler checks. A second type of illicit operation is by deception and misrepresentation in which supply houses and even pharmaceutical houses are the victims. A person interested in peddling barbiturates at a fantastic profit has a fictitious physician's letterhead or prescription blank printed and on the basis of it places orders with supply houses. The third source of supply which is said to fall into illegal channels is samples for physicians. Reputedly there are 200 different brands of sleeping pills and 1,300 drug houses compound and package one or more preparations. In order to encourage the sales of their products, these companies regularly send samples to physicians. A widespread amount of these products is

said to contribute to the vast illicit traffic.

On the other hand, this image of a vast illegal traffic is not shared by all authorities. Some assert that there is no evidence of production of barbiturates in the United States designed exclusively for illicit sale. They add that although the extent of diversion of barbiturates from legitimate to illegitimate channels is unknown, the infrequency of charges of this practice would lead to the belief that it is comparatively small.

### Previous Recommendations

In 1943 in the belief that barbiturates were being sold indiscriminately, the commissioner and deputy commissioner of health of New York City requested the Committee on Public Health to consider the subject and to recommend a solution. At that time the Sanitary Code of New York City included barbiturates among the harmful drugs which could not be dispensed without a written prescription. It further provided that any prescription containing barbiturates should not be renewed or refilled by a pharmacist if it bore any indication to that effect.

The health department was of the opinion that in the indiscriminate use of barbiturates the supply was from two sources: (1) over-the-counter sale by pharmacists; (2) refilling of prescriptions by pharmacists. As a possible control of the second source the deputy commissioner suggested an alternative: (1) to prohibit the refilling of all prescriptions containing barbiturates, a procedure that admittedly might be highly unpopular; or (2) to undertake an educational campaign among physicians to make more frequent use of their prerogative to limit prescriptions to a single filling. The opinion of the Committee on Public Health was sought concerning the desirability of these proposals.

The committee stated its belief that it was inadvisable to prohibit the refilling of all prescriptions containing barbiturates since such a

policy would work an undue hardship on those patients who might be required to use barbiturates continuously; for example, epileptics. As for the alternative course of action, the committee doubted whether physicians should be asked to antagonize patients by writing "nonrefillable" on prescriptions inasmuch as the physicians' motives would certainly be misconstrued.

The committee recognized two other methods by which the sale of barbiturates might be further controlled: (1) the Sanitary Code might be revised to provide that prescriptions for barbiturates should not be refillable unless the physician indicated otherwise; and, (2) prescriptions for barbiturates might carry an expiration date of 6 months or perhaps a year. Exceptions might be made for prescriptions in which the barbiturate was not the main ingredient.

After consideration of all the aspects, the committee reached the conclusion that the use of barbiturates did not then constitute a sufficient problem in public health to warrant the adoption of any measures for restriction beyond those then in the Sanitary Code. It was believed that the production of barbiturates was not unduly large in view of the number of epileptics. Moreover, the committee reasoned, further control of the sale of barbiturates would not materially reduce the number of suicides, since a person bent on self-destruction by barbiturates could go from physician to physician in order to obtain a sufficient quantity or could resort to other methods of suicide. The committee summarized its position: "In view of the fact that the barbiturates do not present a large public health problem from the point of view of suicides, toxic psychoses, addiction, or chronic poisoning, and since the suggestion for the further control of their sale by the department of health would either work a hardship on those who must use these drugs almost continuously, or would place physicians in an unnecessarily difficult position, or would prove unenforceable, the committee is of the opinion that no revision in the Sanitary Code should

venient to consider this issue over the source under the headings: misuse of a prescription, and misuse without a prescription.

*Misuse of prescription.* To be considered under this topic is the charge that many of the prescriptions for barbiturates are unwarranted, ill-advised, or contraindicated. This point has already been discussed under promiscuous use. The extent to which prescriptions include barbiturates was also cited there. It has been pointed out that from such information as is available the physician is prescribing barbiturates justifiably for symptomatic relief in patients who have actual complaints, and that if specific remedies were available he would gladly turn to them.

Sleeplessness and tension are probably the two most frequent complaints for which the physician prescribes barbiturates. Locket and Angus report that in 62 out of 61 cases of barbiturate poisoning, the barbiturate was prescribed for the patient by his medical practitioner; and in more than 90 percent it was given for insomnia either alone or as the major complaint. Certainly such a therapeutic measure by a physician is neither irrational nor unwarranted. On the contrary, the physician is performing his professional duties by the best method available to him.

Another part of the same charge concerning prescriptions for barbiturates is based on their being a source of supply for suicides. Of the 64 patients with barbiturate poisoning reported by Locket and Angus, 49 were suicidal attempts; 9 had made one or more previous attempts. Nineteen were diagnosed as having a severe depressive state; 12 had severe social and domestic disturbances. Some of the patients had previously been in mental hospitals. All had obtained barbiturates by prescription. On studying the source of supply in 718 cases of barbiturate poisoning in New York City, Trichter found 52 percent had obtained the barbiturate on prescription from a physician.

In these instances, critics question whether the prescriptions for bar-

biturates were not ill-advised and contraindicated. The inference is that the physician may have exercised poor judgment and failed to establish adequate precautions. A fair, pertinent, and significant question is: What would have happened to patients who committed suicide by a barbiturate if the physician had not prescribed it? It is not improbable that they would have obtained it from another source or would have chosen another means of self-destruction.

This opens up the entire subject of suicides, not just those from barbiturates. It is beyond the scope of this report to go into that subject in all its ramifications. But for present purposes it should be stated that some patients may give no indication of contemplated self-destruction. Furthermore, when patients issue threats or declare intentions, they seldom utter them in the presence of the physician, and the family either dismisses them or fails to transmit the information. Consequently, all too frequently the physician is not alerted to the possibility of suicide. Moreover, not all persons who issue threats carry them out. Thus it is not easy to reach a decision about the probability of suicide in a patient. Nor is the course of preventive action simple and unobstructed. The patient, or the family, or both, may resist recommendations of supervision and institutionalization. What is virtually demanded is an infallible method of detecting prospective suicides and of thwarting their plans, often without recourse to hospitalization. This, the physician does not have. Yet he must try to bring relief to patients from their complaints. When the situation is viewed in its broad frame, it is at least an open question whether the physician's prescription for a barbiturate to relieve insomnia, anxiety, or tension is ill-advised or contraindicated on the grounds that the patient might commit suicide.

The second type of alleged misuse of prescriptions for barbiturates is the charge that the therapeutic prescription from the physician is very often for amounts beyond the immediate need of the patient. It is probably true that in an attempt to re-

lieve the patient of expenditure of time and money in repeated office visits, the physician may issue prescriptions for barbiturates in excess of the patient's immediate need. Unfortunately, some patients either cannot or will not exercise due judgment in taking the medication as directed; some may save their pills for suicidal purposes. The *Lancet* has reported on two persons who committed suicide, both of whom had been given a fortnight's supply of barbiturates. One had received 72 tablets 10 days before his death, of which only 4 remained. There are no data to indicate the frequency with which physicians prescribe barbiturates in unreasonably generous amounts.

As a third type of misuse of prescriptions it is said that pharmacists and physicians collaborate in dispensing barbiturates indiscriminately but technically in a legal manner. It is asserted that the pharmacists sell barbiturates to persons with no prescription at the time of sale but subsequently the transaction is covered by a collaborating physician who provides a prescription without seeing the patient.

In the fourth type of misuse of prescriptions, the pharmacist is alleged to dispense barbiturates beyond the amount specified in the prescription. Commenting on the seeming unreasonableness of having to return later for an additional supply, the customer asks whether a greater amount than specified in the prescription can be sold. It is conceivable that some pharmacists may yield to accommodating the customer by meeting his request.

At present there are no figures to indicate the number of instances in which these various types of misuse of prescription occur. By some there is said to be flagrant abuse and that it constitutes a considerable source of supply for potential misuse. Others regard this source of supply as negligible.

*Without a prescription.* In considering source of supply there is another category comprising the various ways in which barbiturates are obtained without a prescription. Three different types of procedure fall under this heading. In the first,

and in the main duplicated section 1360a of the 1939 law. The basic requirement was a written prescription. In 1946 section 1360a was newly entitled "Barbiturate and Other Hypnotic and Somnifacient Drugs" and was expanded to essentially its present form. In 1947 following a new revision of the Education Law, section 1360a was renumbered to section 6814. Minor changes were made in the phraseology of the section; and numbering of the subsections was standardized.

Section 6814 has continued to the present without change. It is dissimilar to the committee's recommendations in several respects:

1. It permits a prescription for barbiturates to be refilled unless it bears a direction to the contrary. If the prescriber fails to specify "not to be refilled" or an indication of the refillable time period, then the prescription may be refilled during a period of not more than 6 months. Furthermore, the prescription shall not be refilled prior to the end of the period for which the medication should last.

2. It carries no provision for the physician to dispense barbiturates directly to the patient.

3. It contains no provision requiring the pharmacist to keep records of bills for purchase of barbiturates; and,

4. It does not require manufacturers, wholesalers, and jobbers to maintain a record of amounts of barbiturates received, distributed, or sold.

Section 1747b of the Penal Law of New York State entitled "Sale or Possession of Barbiturate Drugs or Preparations" carries a penalty for unauthorized sale or possession of barbiturate drugs or preparations.

### *Other States*

The Drafting Committee of the Council of State Governments drafted a model bill entitled "Hypnotic or Somnifacient (sleep-producing) Drugs Act" which appeared in its report on Suggested State Legislation Program for 1955. The council is the research and law writing agency of the Conference of State Governors which is held an-

nually to consider methods of achieving greater economy and efficiency in State government. This model law is similar to the recommendations by the Committee on Public Health except in the following particulars: Although it requires that refilling of a prescription must be specifically authorized, it does not specify a minimum interval between renewals, the total number of renewals, and the expiration date of the prescription. On the other hand, it includes a section on penalties. One of the provisions in the model law is similar to that recommendation of the Committee on Public Health which was not adopted in the Sanitary Code; namely, the physician must maintain records of barbiturates distributed by him.

In response to a questionnaire on the model law, the council heard from 34 out of 48 States. Alabama, California, Iowa, Maine, New Jersey, North Carolina, South Carolina, Texas, and Wisconsin indicated that legislation substantially similar to the draft of the model law was approved in each State prior to 1955. Indiana, Massachusetts, Montana, Nebraska, and Rhode Island have indicated that legislation substantially similar to the model act was passed during the 1955 legislative sessions.

### *Federal*

Federal control over the sale of barbiturates is exercised by the United States Food and Drug Administration through application of the misbranded drug and device provisions of the Federal Food, Drug and Cosmetic Act of 1938, sections 502 and 503. Prior to 1951, Food and Drug Administration prosecutions for the sale of barbiturates without prescription rested on the charge of misbranding under section 502 which specified 10 types.

Of these the following four covered in section 502 (b), (d), (e), and (f) should be especially considered: A drug and device in packaged form shall be deemed to be misbranded:

1. Unless it bears a label containing the name and place of business of the manufacturer, packer, or dis-

tributor; and an accurate statement of the quantity of the contents.

2. Unless the label on a narcotic or hypnotic substance bears its name and quantity; and the statement "Warning—May be habit forming." By the terms of the section barbiturates are defined as habit forming.

3. If it is not designated solely by a name recognized in an official compendium, unless its label bears the common or usual name of the drug or each active ingredient, including the quantity or proportion of substances specified in the subsection.

4. Unless its labeling bears adequate directions for use and such adequate warnings against use in instances where it may be unsafe. Under the accompanying regulation of this fourth provision, shipment or delivery of prescription drugs, including barbiturates, were exempted if the label contained the statement "Caution: Federal law prohibits dispensing without prescription."

Section 503 (b) of the Federal Food, Drug and Cosmetic Act of 1938 provided that drugs dispensed on prescription were exempt from the first and third labeling requirements. This section further provided that if the prescription was marked non-refillable or refill was prohibited by law, the drug dispensed was exempt from the requirements that the label carry the name and quantity of narcotic or hypnotic substance, and the statement "Warning—May be habit forming."

In 1951 section 503 (b) was amended by the so-called Durham-Humphrey Act which replaced the previous provisions of that section. This new section provides essentially that:

1. A drug intended for use by man which:

- (a) is a habit-forming drug to which section 502 (d) applies [narcotic and hypnotic substances]; or

- (b) because of its toxicity or other potentiality for harmful effect, is not safe for use except under supervision of a practitioner licensed by law to administer such a drug; or

- (c) is a new drug limited to use under the professional supervision of a practitioner licensed by law to

be recommended at the present time."

Because of the reported growth of illicit trade in barbiturates and the increase in accidental poisonings and suicides by them, the Committee on Public Health in 1915 at the request of the commissioner of health of New York City again considered the desirability of extending restrictive measures regarding their sale and distribution. The commissioner submitted to the committee a draft of proposed regulations which had been formulated in cooperation with the New York office of the Federal Bureau of Narcotics.

After studying the problem and the suggested proposals, the committee came to the conclusion that stricter measures of control over the sale and distribution of barbiturates were warranted. The suggested extension of control, however, was not to operate to interfere with the freedom of physicians in their practice; rather, it was aimed to guard against misuse of barbiturates by the dispenser and the user.

The committee recommended the following specific regulations:

1. Prescriptions should be refillable when so indicated by the issuing physician; but such prescriptions should indicate a minimum interval between renewals and the total number of renewals. No prescription containing a barbiturate should be refilled after 6 months from the date of issuance.

2. Pharmacists should not reveal the content or furnish copies of prescriptions to patients.

3. Prescriptions should carry suitable information about the identity of the patient and the prescriber.

4. In an emergency a physician should be allowed to transmit to a pharmacist by telephone a prescription for not more than six average doses of barbiturate drugs provided a written prescription is supplied to the dispensing pharmacist within 72 hours. Should the pharmacist fail to receive such a written confirmation, he should notify the health department of the omission.

5. Proper records of dispensed barbiturates should be kept by physicians, dentists, and veterinarians.

6. Manufacturers, wholesalers, and jobbers should maintain suitable records of sales and distribution, and inventories of stocks.

7. Pharmacists should keep records of bills of purchase of barbiturates and copies of prescriptions on which such drugs were dispensed, including notation of amounts dispensed upon refilling.

8. Barbiturates should not be supplied to any person except on prescription or in the course of legal sale within the drug trade.

All of these recommendations in either their original or a slightly varied form were incorporated into the Sanitary Code by the end of 1917. They are presently in force.

## Legislation

### *New York City*

Prior to October 11, 1922, the Sanitary Code contained no specific provision concerning the sale of barbiturates. They were regulated by the provisions applicable to all other drugs. These regulations included:

1. Registration with the New York City Department of Health of non-prescriptive proprietary and patent medicines;

2. Provisions against misbranding, imitation, and substitution; against false and misleading statements; and against failure to disclose alcohol, narcotics, chloroform, chloral hydrate, and acetanilid;

3. Prohibition against dispensing a prescription, decoction, and medication under false or misleading name, direction, or pretense.

In 1922 the board of health adopted section 126 of the Sanitary Code which was entitled "Veronal, etc. sale regulated." This section forbade the sale at retail, except upon written prescription, of veronal, veronal sodium, luminal, and luminal sodium, together with sulphonal, tninal, and tetranol. Additionally, these substances were designated by chemical name, and provision was made that the section apply to these drugs by whatever name called or known.

In 1940 the Sanitary Code was amended by section 116 on prohibition of manufacture and sale of

adulterated and misbranded drugs which incorporated the provisions of section 502 of the Federal Food, Drug and Cosmetic Act of 1938. This section applied to all drugs.

In the same year the Sanitary Code was further amended by section 118 which regulated more fully the sale of barbiturates in New York City. Barbiturates were included among the drugs which could not be dispensed without a written prescription, and this prescription could not be refilled if it bore an indication to that effect.

The 1945 recommendations of the Committee on Public Health were for the most part adopted by the board of health in 1947 as amendments section 118 b, c, d, and e to the Sanitary Code. Differences from the recommendations were: The life of the original prescription was reduced to 3 months. The recommendation requiring physicians to keep records of barbiturates dispensed was not adopted. Instead, labelling of the container by the physician dispensing barbiturates was specified. The provision allowing for filling of a telephone prescription for barbiturates did not appear in the amendments of 1947 but was adopted in 1948.

### *New York State*

There was no specific legislation on barbiturates or other hypnotic or somnifacient drugs prior to 1939. In that year the Education Law was amended by addition of section 1360a entitled "Hypnotic and Somnifacient Drugs" which by definition included barbiturates. The basic requirement was a written prescription. Later in 1939, article 51 regulating the practice of pharmacy was completely revised to incorporate the provisions of the Federal Food, Drug and Cosmetic Act of 1938 with respect to drugs and cosmetics. During this revision section 1360a was repealed. No specific legislation on barbiturates was again introduced into the Education Law until 1945.

In 1945 a new section 1360a, entitled "Hypnotic and Somnifacient Drugs" was introduced into the Education Law. By definition this section again included barbiturates

of enforcement of existing State and city laws and the possibilities for the future might well be explored before turning the responsibility too quickly over to a Federal bureau.

It is the opinion of the committee that the model law for States to control barbiturates, which is patterned after its recommendations of 1945, is a highly effective legislative measure containing adequately restrictive provisions. The fault lies not in the terms of this law: indeed, it is much more restrictive and in its approach is capable of exerting much more control than are the existing Federal statutes.

Rather, the present inadequacies in controlling barbiturates are of another kind. They are four in number: First, the model law has not been adopted by all; indeed, not by a majority of the States. This is not just a matter of gross negligence or apathy. It takes time to achieve legislative remedies for social problems. But before judging the adequacy of the model law and the capability of the States to control barbiturates through it, it would seem reasonable that the law be on the books. How can effective control be expected when only 13 States have adopted the measure? How can New York City enforce its model regulations to greatest effect, assuming that it had sufficient personnel, when the rest of New York State and some of the adjoining States are exempt? In view of the demonstrated magnitude of barbiturate poisoning in New York City, the blocking of these loopholes is important. Because of the apparent concentration of the barbiturate problem in urban areas, large cities with home rule in the various States should also have laws patterned after the model act.

Second, in those States which have accepted the model law, it has been so recently adopted that its enforcement has in all probability not reached the level that might be hoped for. But time is not the only reason. Even in New York City with its highly restrictive regulations in effect since 1947, it would require considerable temerity to argue that enforcement has been exemplary. Nor should the health department be

criticized or censured. To examine properly the records of manufacturers, wholesalers, jobbers, and pharmacists requires an adequate staff of inspectors. For this the department has never had the necessary number of personnel. It has only 20 pharmacy inspectors, burdened with many other duties, to patrol 4,000 retail pharmacies and 500 jobbers, wholesalers, and packagers. It is absurd to demand more stringent laws when there is so little provision for enforcement of sufficiently strong existing measures in the Sanitary Code of New York City. More laws will not compensate for an insufficient number of inspectors.

Nor would a vast force be required. A reasonable number of inspectors engaged full time and regularly in auditing the records of pharmacies, wholesalers, and jobbers might soon instill honesty among all transactors, particularly if the element of surprise was utilized. By much the same system bank examiners have exercised a salutary influence. The problem of barbiturate poisoning in New York City has been shown to be proportionately much greater than it is in the Nation. Therefore, if the situation in New York City were improved, it would go far toward reducing the national incidence of barbiturate poisoning.

It is believed that the misuse of barbiturates is concentrated in urban areas, particularly large cities; accordingly, it follows that enforcement efforts should be concentrated there. For that a Federal Bureau is not needed.

Third, ignorance and a casual attitude have been the prevailing atmosphere surrounding barbiturates. The public has been unaware that this valuable family of hypnotics, like almost all other medication, is not without its dangers when misused. Those who know the risk of misuse, the physician and the pharmacist, have apparently not adequately informed or sufficiently impressed the patients about it.

Even after studying the figures on prevalence of use and misuse of barbiturates, the source of supply, and the legislative controls, the

committee is convinced that it has not yet come to the core of the situation. Why is there widespread use and misuse of barbiturate-containing sedatives and sleeping pills? There must be a reason. That widespread practice must be symptomatic of an underlying condition. The committee can only come to the conclusion that there exists all too much unrest, anxiety, and tension in the public.

Under these circumstances, such a radical step as prohibiting the use of the therapeutically valuable barbiturates on the grounds that it would remove a means of self-destruction would not be a sensible action or a sure corrective. With equal reason it might be argued that all high bridges and buildings should be razed, and all gas lines should be disconnected. True, it is an imperative duty to throw every reasonable safeguard around the use of barbiturates. Nevertheless, that is not a true remedy which will bring effective and permanent relief. At best it is treating the symptoms of a disease, not its cause. Now perforce it is the main recourse.

But there must also be a more fundamental approach to the solution. What is needed is a means of preventing the prevalent unrest and anxiety. For that it is necessary to have knowledge about the causes of the emotional manifestations that so abound in society. Furthermore, effective prevention of suicide can come only through an understanding of the factors that bring about a morbid state that leads to a desire for self-destruction. Knowledge on these points can only come through research. Until recently the amount expended for research on mental and emotional disorders was so infinitesimally minute as to be insignificant. Even now the manpower and funds for investigations in this area are so limited in comparison with the transcendent importance of the subject as to make the need a clarion challenge.

In sum, the committee concludes that available model legislation is adequately restrictive, but it has not been widely enough adopted; where it has been put into effect, it has not been enforced. Moreover, such

administer such a drug, shall be dispensed only:

(i) upon a written prescription, or

(ii) upon an oral prescription reduced promptly to writing and filed by the pharmacist, or

(iii) by refilling any written or oral prescription if the refilling is authorized by the prescriber either in the original prescription or by oral order which is reduced promptly to writing and filed by the pharmacist.

A drug dispensed contrary to above provisions shall be deemed misbranded.

2. Any drug dispensed by filling or refilling a written or oral prescription of a practitioner licensed by law to administer such drug shall be exempt from misbranding as specified in section 502, except as to false and misleading labeling, imitation of another drug, substitution, and packaging requirements, if the drug bears a label containing the name and address of the dispenser, the serial number and date of the prescription or of its filling, the name of the prescriber, the name of the patient, the directions for use, and any cautionary statements contained in the prescription.

3. The administrator may by regulation exempt habit forming drugs and new drugs from prescription requirements, when these are not necessary for the protection of public health.

4. A drug which is subject to the prescription requirement shall be deemed to be misbranded if at any time prior to dispensing its label fails to bear the statement: "Caution: Federal law prohibits dispensing without prescription." A drug not subject to prescription shall be deemed to be misbranded if at any time prior to dispensing its label bears the caution statement.

The United States Food and Drug Administration now uses section 503 (b) (1) in prosecuting violative sales of prescription drugs, including sales of barbiturates. It has been noted that the statement "Warning—May be habit forming" was formerly required on labels for both stock and dispensing containers of

barbiturates except when the prescription was marked "nonrefillable" or its refilling was prohibited by law. Under revised section 503 (b), as provided in the Durham-Humphrey Act, barbiturates dispensed on legal prescription do not require the statement "Warning—May be habit forming" on the label of the dispensing container.

It will be noted that the Federal law, while placing barbiturates on the prescription list, controls their manufacture and distribution by specifications of misbranding. Except for the requirement of a prescription, this approach is separate and distinct from that recommended by the Committee on Public Health. Even in the requirement for a prescription, there is no restriction on refilling, such as the minimum interval, number of refillings, and life of the prescription.

When the Durham-Humphrey Act went into effect in 1932, pharmaceutical associations and pharmacy boards in 11 States decided that the laws in their States which control the sale of drugs should be amended to bring them into conformity with the Federal statute. This action was proposed in order to eliminate the confusion to which druggists were subjected in operating under two conflicting statutes. The laws of these States were in conflict with the Federal Durham-Humphrey Act on one or both of two points: prohibition against refilling of barbiturate prescriptions, and against filling telephoned prescriptions, both of which are permitted under the Durham-Humphrey Act.

Whenever State and Federal laws conflict, the stricter law prevails. Unaware of this, some pharmacists have thought that because the Federal law permits the refilling of barbiturate prescriptions and the filling of telephoned barbiturate prescriptions, such practices are proper even though the State law bans them. Harmonizing of the laws would end this confusion. In 20 States no amendment was needed to bring their laws into conformity with the Durham-Humphrey Act. Furthermore, the model State law on barbi-

turates does not conflict with Federal regulations.

## Discussion and Conclusions

It is clear that the incidence of both fatal and nonfatal barbiturate poisoning is of such a magnitude that it constitutes a problem in public health. Because it includes poisonings both under accidental circumstances and from suicidal attempt, any plan for reduction must take cognizance of these two separate aspects. It is further evident that the rate of incidence is very much higher in New York City than in the United States.

As a solution to the barbiturate problem there has been a loud demand for Federal supervision, variously expressed as stiffer Federal laws, tighter Federal control over distribution, Federal regulations similar to those for narcotics. But both commercially and pharmacologically, barbiturates are dissimilar to narcotics. It should be remembered that narcotics come from a foreign source and that the basis of control is a revenue measure. In contrast, the barbiturates are domestically produced and the model act now in effect in some States and proposed for all is much stricter; in fact, it could not with reason be much more strict. Certainly the Harrison Act for narcotics is not appropriate for or applicable to barbiturates. If what is wanted is more restrictive Federal legislation because of seeming legal inadequacy in some States, the model act for States should be carefully studied before clamoring for a Federal panacea.

Another form of demand for Federal regulation is that the Narcotics Bureau be given enough money and personnel to carry out a program to control the manufacture, distribution, and sale of barbiturates. To place this responsibility on a bureau that is already overburdened with the gigantic task of coping with illicit narcotic traffic would add an additional handicap that would indeed be formidable. It is asserted that the Narcotics Bureau is most inadequately supported for its present work. Here again the present status



of enforcement of existing State and city laws and the possibilities for the future might well be explored before turning the responsibility too quickly over to a Federal bureau.

It is the opinion of the committee that the model law for States to control barbiturates, which is patterned after its recommendations of 1945, is a highly effective legislative measure containing adequately restrictive provisions. The fault lies not in the terms of this law; indeed, it is much more restrictive and in its approach is capable of exerting much more control than are the existing Federal statutes.

Rather, the present inadequacies in controlling barbiturates are of another kind. They are four in number: First, the model law has not been adopted by all; indeed, not by a majority of the States. This is not just a matter of gross negligence or apathy. It takes time to achieve legislative remedies for social problems. But before judging the adequacy of the model law and the capability of the States to control barbiturates through it, it would seem reasonable that the law be on the books. How can effective control be expected when only 13 States have adopted the measure? How can New York City enforce its model regulations to greatest effect, assuming that it had sufficient personnel, when the rest of New York State, and some of the adjoining States are exempt? In view of the demonstrated magnitude of barbiturate poisoning in New York City, the blocking of these loopholes is important. Because of the apparent concentration of the barbiturate problem in urban areas, large cities with home rule in the various States should also have laws patterned after the model act.

Second, in those States which have accepted the model law, it has been so recently adopted that its enforcement has in all probability not reached the level that might be hoped for. But time is not the only reason. Even in New York City with its highly restrictive regulations in effect since 1947, it would require considerable temerity to argue that enforcement has been exemplary. Nor should the health department be

criticized or censured. To examine properly the records of manufacturers, wholesalers, jobbers, and pharmacists requires an adequate staff of inspectors. For this the department has never had the necessary number of personnel. It has only 20 pharmacy inspectors, burdened with many other duties, to patrol 4,000 retail pharmacies and 500 jobbers, wholesalers, and packagers. It is absurd to demand more stringent laws when there is so little provision for enforcement of sufficiently strong existing measures in the Sanitary Code of New York City. More laws will not compensate for an insufficient number of inspectors.

Nor would a vast force be required. A reasonable number of inspectors engaged full time and regularly in auditing the records of pharmacies, wholesalers, and jobbers might soon instill honesty among all transactors, particularly if the element of surprise was utilized. By much the same system bank examiners have exercised a salutary influence. The problem of barbiturate poisoning in New York City has been shown to be proportionately much greater than it is in the Nation. Therefore, if the situation in New York City were improved, it would go far toward reducing the national incidence of barbiturate poisoning.

It is believed that the misuse of barbiturates is concentrated in urban areas, particularly large cities; accordingly, it follows that enforcement efforts should be concentrated there. For that a Federal Bureau is not needed.

Third, ignorance and a casual attitude have been the prevailing atmosphere surrounding barbiturates. The public has been unaware that this valuable family of hypnotics, like almost all other medication, is not without its dangers when misused. Those who know the risk of misuse, the physician and the pharmacist, have apparently not adequately informed or sufficiently impressed the patients about it.

Even after studying the figures on prevalence of use and misuse of barbiturates, the source of supply, and the legislative controls, the

committee is convinced that it has not yet come to the core of the situation. Why is there widespread use and misuse of barbiturate-containing sedatives and sleeping pills? There must be a reason. That widespread practice must be symptomatic of an underlying condition. The committee can only come to the conclusion that there exists all too much unrest, anxiety, and tension in the public.

Under these circumstances, such a radical step as prohibiting the use of the therapeutically valuable barbiturates on the grounds that it would remove a means of self-destruction would not be a sensible action or a sure corrective. With equal reason it might be argued that all high bridges and buildings should be razed, and all gas lines should be disconnected. True, it is an imperative duty to throw every reasonable safeguard around the use of barbiturates. Nevertheless, that is not a true remedy which will bring effective and permanent relief. At best it is treating the symptoms of a disease, not its cause. Now perforce it is the main recourse.

But there must also be a more fundamental approach to the solution. What is needed is a means of preventing the prevalent unrest and anxiety. For that it is necessary to have knowledge about the causes of the emotional manifestations that so abound in society. Furthermore, effective prevention of suicide can come only through an understanding of the factors that bring about a morbid state that leads to a desire for self-destruction. Knowledge on these points can only come through research. Until recently the amount expended for research on mental and emotional disorders was so infinitesimally minute as to be insignificant. Even now the manpower and funds for investigations in this area are so limited in comparison with the transcendent importance of the subject as to make the need a glaring challenge.

In sum, the committee concludes that available model legislation is adequately restrictive, but it has not been widely enough adopted; where it has been put into effect, it has not been enforced. Moreover, such

widespread usage of barbiturates can only indicate extensive unrest, anxiety, and tension in the people. The methods to prevent this situation are still unknown. Finally, the public's knowledge and the general attitude about barbiturates do not now appear to be conducive to a more temperate and reasonable use of barbiturates.

## Recommendations

As rational steps toward stopping the misuse of barbiturates and especially reducing the present high rate of incidence of barbiturate poisoning, the Committee on Public

Health offers the following recommendations:

1. The model law controlling the manufacture and distribution of barbiturates should be adopted by all the States. Large cities with home rule should also have laws patterned after this act.

2. A realistic effort toward enforcement of the model law when enacted is an essential step. An adequate staff of inspectors to examine records should be organized. Efforts at enforcement should be concentrated on the large cities, where the rates of incidence of barbiturate poisoning are highest.

3. An educational campaign

should be conducted by health departments, and medical and pharmaceutical societies to remind their members of their responsibility of acquainting patients with the dangers of misuse of barbiturates. At the same time there should be a campaign, using all media, to inform the public of the risks attached to the misuse of barbiturates.

4. Above all, it is highly desirable that adequate funds should be provided to support research on the causes of unrest, anxiety, and tension that are so prevalent among the population and are the basis for such great use and misuse of barbiturates.

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# Proprieties of Tuberculosis Management

By W. M. PECK, M.D.

THE PATTERN of tuberculosis control changes constantly. It changes in response to new information and needs, altered economy, predominant personalities and fads. Sometimes it flounders in complacency; other times it changes with almost chaotic flurry. But always guiding and determining this pattern are three components, the health department, the private physician, and the sanatorium, each performing a specialized function.

Since tuberculosis, as a contagious disease, is essentially a public health problem, the health department must occupy the position of overall responsibility and initiative. The private physician must guide the attitude of the patient and his community and plead the right of the individual. And the sanatorium, with its clinical and laboratory resources for research, must work out new methods of treatment and new concepts to support a changing and progressive program. Yet it is true that sanatorium physicians, in their more or less monastic seclusion, speak mostly to other sanatorium physicians, and public health physicians may be equally guilty of similar parochial practices. Since we are now in one of the more chaotic periods of change with aspects that are both heartening and hazardous, it is important that

these groups maintain the closest possible communication with one another so they may work together wisely and with adaptability through this unusual period of turbulence.

Up to now it has been customary to assert as a dictum that the basic philosophy of treatment has changed little and that drug therapy and surgery are only serviceable adjuncts to an established and time proved system. But now we must recognize that the basic philosophy itself is changing and that this constitutes the most radical departure in the changing pattern of control.

The traditional concept, which is now giving way, was starkly realistic and recognized the uncertainty of predrug therapy and the fact that tuberculosis was essentially a relapsing disease. It aimed at bringing the patient into tentative equilibrium with his disease and at maintaining that precarious balance by sheltered, restricted living. It was harsh treatment. When a patient entered the sanatorium there was forced on him a sudden break in the continuity of his life. Life plans were stripped from him and reconstituted along lines of minor attainment and little responsibility. The usual values were inverted: ambition became evil and laziness a virtue. There was a suggestion of other-worldliness, of Magic Mountain mystery about the treatment, a certain ecstasy which sustained the patient without realism and eventually enervated him. He was taught the doctrine of submission and introduced to the numbing despair of relapse through such slogans as "once tuberculous, always tuberculous." Some patients survived their illness to acquire success or even greatness, but many succumbed

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*Dr. Peck, presently serving as chest consultant for the North Carolina State Board of Health, Raleigh, was previously medical director and associate superintendent of the North Carolina Sanatorium, McCain. He is the current president of the Southern Trudeau Society.*

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to the trivial life of semi-invalidism. Thus the "cure" in days when there was no justifiable alternative.

But since then, in a matter of a very few years, a nearly specific group of drugs has appeared, changing the course and behavior of tuberculosis to an extent that it has little in common with the disease we knew only 10 years ago. Such fundamental aspects as its pathology, bacteriology, and perhaps even its epidemiology have been altered by drug action. The significance of these changes we have been slow to recognize and accept because of our innate distrust of the disease and its record for relapse. But now we are beginning to see that with optimal treatment recovery is nearly predictable and that the relapse rate—if we can project short-term results—has dropped almost to the point of removing tuberculosis from the category of a relapsing disease.

This is a difficult adjustment for all of us to make, but obviously we, who deal with tuberculosis, must "catch up" with this new type of disease and exploit its changes for the benefit of the patient and the control program. The period of hospitalization has already been shortened considerably and, as we gather confidence, probably can be shortened more, perhaps very much more. Patients now return to work within a few months of discharge and usually to their previous employment. The need for treatment in tuberculosis, then, no longer should be regarded as an overwhelming personal tragedy, and the period of sanatorium care, though intense and highly specialized, should be regarded merely as an episode which, in itself, does not disrupt or materially alter the continuity of one's life.

These optimistic remarks, of course, cannot apply to all who enter a sanatorium. Belated diagnosis and delayed admission still carry some patients past a point of possible return of adequate function. Some of these still die from tuberculosis; others survive as pulmonary cripples to whom one can offer only prolonged custodial care.

### Treatment Regimen

Let us turn now to the treatment which has justified such a reversal of concept.

The goal of drug treatment, ideally, would be to sterilize the lesion of all tubercle bacilli with reversion of the tuberculin reaction. But under usual clinical conditions with our available drugs, this goal cannot be fully realized. Fortunately, there is a tangible alternate goal which falls just short of ideal. This is based on the faculty of drugs, especially of isoniazid, to destroy those bacilli which are in an active phase of multiplication and to depress the metabolic activities of the remaining organisms to a point of inertness, comparable, perhaps, to hibernation—a unique and definite vegetative state. Bacteriologists have shown that many of these bacilli cannot be induced to grow on culture media, whereas others will grow with difficulty only after many months of incubation or with special stimulation. In this dormant state tubercle bacilli continue to produce sufficient tuberculo-proteins to maintain a positive tuberculin reaction but not enough to cause progressive disease. Rapid resolution of pneumonic disease and, frequently, cavity closure occur in consequence of this depressed state of the parasite; and we may postulate that host factors—factors which unfortunately permitted disease to develop in the first place—may have opportunity to rectify themselves.

Isoniazid is by far the best drug, and isoniazid and para-aminosalicylic acid seem to be the most satisfactory combination. Drug therapy is usually initiated by these two, and with almost predictable success. When they fail—as they do rarely under favorable circumstances and frequently under conditions of compromise—one loses much of the sureness, and treatment henceforth becomes difficult, specialized, and less certain. Then one must grope with problems of drug resistance, synergism, and toxicity in seeking successful combinations with streptomycin, cycloserine, pyrazinamide, or viomycin. Sometimes the surgeon must remove refractory areas of disease, the persistent cavity or the caseous mass, before sputum can be converted.

The achievement of the dormant state of the bacilli is the first objective, and the second objective is to maintain them in this state. Fortunately, it appears that dormancy can be maintained by the rather simple expedient of continuing drug therapy. Isoniazid by itself

appears to be adequate for this purpose, and ideal since it is pleasant to take and exceedingly low in toxicity and cost. Probably, continued dormancy can be further assured by the prophylactic removal of those areas prone to reactivation such as residual cavities or areas of unresolved disease which may be relatively inaccessible to the blood stream and hence to drug effect.

The tragedy of drug therapy is the ever-present possibility of interruption or compromise in the early course of treatment. The initial exposure to drugs finds the organisms particularly vulnerable. And intense, supervised drug therapy at this time will cause sputum conversion in about 80 to 90 percent of patients in the first 4 months. On the other hand, if initial therapy is inadequate or interrupted, it may have the deplorable effect of merely altering the host-parasite relationship sufficiently to produce a remarkable degree of chronicity, with active, smoldering disease persisting. It may neither improve nor worsen with further treatment.

Usually, there are about 40 such patients in the 700-bed North Carolina Sanatorium at McCain, N. C., many of whom are in its prison division. For the most part they are poor, defeated creatures with long histories of repeated "short bursts" of drug therapy. Characteristically, their shopworn lesions have practically ceased to respond to drugs, even to new ones, such as cycloserine, yet under flagrant abuse they seldom get worse. Prisoners escape and run for hours or days through the swamps. They go on the bum or work at heavy construction for months before being apprehended and returned, still hale and hearty, but with sputum that is unalterably positive. This kind of disease is the stigma of erratic drug therapy and may be produced in the well-meaning, law-abiding citizen as well as the criminal. There is a heavy responsibility on all of us lest, inadvertently by compromise or misdirection, we encourage another to join this forlorn and hopeless crowd. One must never forget that the period of early treatment is a critical one, and the difference between adequate treatment and almost adequate treatment may be relatively slight.

Assurance of proper treatment during this

early crucial period can be given best if the patient is admitted to a sanatorium. Once the organisms presumably become dormant, when the sputum becomes negative and resolution is well under way and any needed surgery is accomplished, the situation alters and much greater latitude is possible. This permits earlier discharge home and earlier return to work under the continued protection of isoniazid for a prolonged period of time, possibly for 1 or 2 years or longer; and this can be done with a degree of safety that is foreign to all earlier experience.

### The Home Care Question

This treatment represents the ideal way for handling the tuberculous patient, and one cannot depart far from the ideal without some jeopardy. The question of home care, however, comes up and must be answered. The possibility of treatment at home is appealing to the patient and his relatives and has enough validity even to command critical medical attention. An argument for a home care program might be presented as follows: Drug therapy if carried out conscientiously will cause conversion of the sputum in 80 to 90 percent of initial treatment cases, and it will do this in spite of great latitude in such ancillary matters as bed rest, good nutrition, and psychotherapy. Accordingly, proponents of a program which relies primarily on home care would provide the following:

1. A system of supervision designed to insure uninterrupted drug therapy.
2. Medical supervision which would (a) endeavor to admit to the program only those patients who might be expected to have rapid sputum conversion, (b) remain alert to the development of complications or possibility of treatment failure, and (c) recognize indications for surgery.

These proponents of home care recognize that such a program is not cheap, particularly since the majority of tuberculosis patients require welfare assistance whether in or out of a sanatorium. They recognize that a considerable staff is required, including medical and nursing staff and social workers. Central clinic, roentgenographic, and laboratory facilities must be readily available. Arrangements must be made

for nurses or social workers, or both, to visit the home at monthly intervals. Lansdown and Jones estimated the cost of treating a New York City welfare patient in his home at approximately \$6 a day whereas the cost for a similar patient in a local sanatorium was approximately \$13 a day. This as well as other estimates would indicate that a home care program is about one-third to one-half as expensive as sanatorium care. Thus, the apparent cheapness of a home care program is largely illusory and is dependent on spreading the cost through a number of departments such as welfare, public health, and social service.

Opponents of a home care program point out that most of the tuberculosis patients come from underprivileged, underendowed groups who cannot assume the responsibility for their care under such a sketchy framework of supervision and that serious lapses of drug therapy will occur. Neither do they believe that bed rest, nutrition, and emotional factors are of so little consequence that they can be left to chance, especially in the determination of long-term results as opposed to short-term sputum conversion rates. They doubt that, without ready access to special facilities, sufficient sputum, gastric, or roentgenographic studies would be made for proper evaluation or that the patient could be readily persuaded to accept surgery at an optimum time. They point out, wisely, that enthusiasm for cheaper care in the home must not blind one to the communicability of tuberculosis or to risk of creating false and disastrous attitudes of nonchalance toward public health aspects of the disease.

### **The Reasonable Attitude**

Until further data are presented a conservative and reasonable attitude in this controversy might be:

1. Where sanatorium facilities exist, reliance should be based primarily on sanatorium treatment, with home care restricted to the convalescent period and to patients temperamentally unsuited to hospitalization.

2. Where sanatorium beds are insufficient and health department personnel and facilities are sufficient to increase activities substantially, a home care program should be developed. This

program should be designed with close coordination existing between the sanatorium and home phases of treatment. Under these circumstances most patients would start treatment within the sanatorium for the initial evaluation and indoctrination and for the establishment of a suitable and tolerated drug regimen. After several weeks or months, depending on the demand for beds, the patient might be transferred (not discharged) to the home care program, but he might return to the sanatorium at later dates for periods of reevaluation or for surgical procedures. This is not an ideal program, particularly for patients who must return to forlorn and crowded homes. But it may be justified by circumstances, and it has been reasonably successful as practiced by Lansdown and Jones in New York City, Lichtenstein in Chicago, and others, especially in urban areas where excessive dispersion of the population is not a factor.

The methods of tuberculosis control, then, are by no means immutable since modern drug therapy permits increased flexibility when fundamental principles of administration are respected and accomplished with certainty. The components of a treatment program—the sanatorium, the clinic, the home—may be used with varying emphasis, depending on community resources. Extensive reliance on sanatorium facilities presents the fewest problems and the further one departs from this convention the greater becomes the responsibility, concern, and financial need of the health departments. Programs relying heavily on clinic and home treatment are indeed possible and even justified by circumstances, but they should be undertaken only after sober evaluation of resources and as a major interest. Even so, under carefully controlled conditions, there is justification for further cautious exploration in this direction. There is danger, however, that home care programs may be undertaken somewhat hastily because of a mistaken assumption of great economy, because of popular clamor, or because of insouciance. And there is danger that home care and sanatorium care may be pitted against one another in wasteful competition. Such attitudes must not be tolerated. Instead one must seek constantly to command optimum use of all these community resources.

This concept presents us with opportunity

for building a program on a much broader and more secure base, an opportunity for freshening and strengthening a campaign which has lost much of its momentum, an opportunity for

reawakening those forces which once distinguished tuberculosis control measures as an actual crusade in which the entire community eagerly joined.

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## Federal Water Pollution Control Act of 1956

Federal grants to assist municipalities in the construction of necessary sewage treatment works as a pollution control and water conservation measure, to be administered by the Public Health Service, are authorized in the Federal Water Pollution Control Act of 1956 (P. L. 860, 84th Cong.).

The act also authorizes up to \$3 million a year for a 5-year program of grants to States and to interstate water pollution control agencies to assist them in developing their own water pollution control operations. A revised Federal enforcement procedure for control of interstate water pollution and greater Federal support for research are among other important provisions of the act.

Under the revised enforcement procedure, Federal court action to abate interstate water pollution may be taken by the Government at the request either of the State in which the pollution originates or of the State affected by the pollution. Under the 1948 act, the consent of the upstream State was required.

The 1956 act also authorizes an intensified program of research, technical assistance, and training. Research work at the Public Health Service's Robert A. Taft Sanitary Engineering Center at Cincinnati, Ohio, will be augmented by means of research grants, contracts, and fellowships.

The statute authorizes Federal grants of \$50 million a year (up to an aggregate of \$500 million) for the

construction of municipal sewage treatment works.

### Construction Grants

The supplemental appropriation for the current fiscal year includes \$50 million for construction grants which are to be allotted on the basis of population and per capita income. Under the act, individual grants are limited to 30 percent of the estimated reasonable cost of the project or \$250,000, whichever is less. The act requires that at least 50 percent of the grant funds be used to assist in construction of treatment works serving communities of 125,000 or less.

A project must meet six basic requirements to be eligible for a Federal construction grant: (a) The project must be approved by the home State's water pollution control agency; (b) it must conform to a State water pollution control plan submitted pursuant to the act; (c) it must be included in a comprehensive water pollution control program of the Public Health Service; (d) the applicant must agree to pay the remaining construction costs; (e) the applicant must make provision for insuring proper and efficient operation and maintenance of the project after construction; and (f) the home State's water pollution control agency must certify that the project is entitled to priority over other eligible projects on the basis of financial as well as water pollution control needs.

### Application Procedures

Preliminary information on the operation of the new act continuing Federal-State cooperation in controlling water pollution has been released by Surgeon General Burney. Placed in charge of the initial operation of the program is Curtiss M. Everts, chief sanitary engineer of the Oregon State Board of Health.

Application forms and related materials will be available to municipal officials and others concerned from State and interstate water pollution control agencies, from the regional offices of the Department of Health, Education, and Welfare, and from the Public Health Service in Washington, D. C.

After completing the form, the applicant will submit it to his State water pollution control agency for approval and request notification on whether the project meets the requirements of the State water pollution control plan.

The Public Health Service will determine which projects satisfy the criteria for propriety of Federal aid and other requirements of the act.

More detailed procedural information will be available with the grant application forms.

Arrangements for the practical application of other provisions of the act are being prepared. The supplemental appropriation also included \$2 million for program grants to States and interstate water pollution control agencies and \$1 million for administration of the various provisions of the act.

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This concept presents us with opportunity

volumes to more than 100,000, and the *Index-Catalogue*, which Dr. William Welch, of Johns Hopkins University, once called the most important contribution the United States had made to medicine, had come into being. Dr. Billings had, in fact, accumulated for the library the world's greatest collection of medical literature.

Likewise, but as a private enterprise, the *Index-Medicus* owes its origin to Dr. Billings' vision. Begun in 1880, the index was united in 1927 with the *Quarterly Cumulative Index* to form the *Quarterly Cumulative Index Medicus*. It is now published by the American Medical Association.

After the First World War the library was renamed the Army Medical Library, and again, in 1952, its name was changed to the Armed Forces Medical Library.

Today the library possesses half a million bound volumes and more than a million titles in medicine, public health, dentistry, and allied sciences in all languages and of all times. More than 10,000 serials are acquired yearly by purchase, gift, or exchange, including about 4,500 journals.

Not only does the library have more than 500 incunabula and many thousands of rare books of later dates, but its collection of theses, also started by Dr. Billings, is unsurpassed. The long runs of periodicals give it a character possessed by few other scientific libraries. Its collection of portraits of medical men and pictures of hospitals is growing daily. Its section of American and foreign government and statistical documents is probably unique.

In addition to acquiring medical literature on a worldwide basis, the library organizes its acquisitions by appropriate bibliographical listing, makes them available to users through interlibrary loans and photographic copies, and provides reference and research assistance. From its beginning, in addition to serving military users, the library has been used extensively by the civilian medical profession.

The library publishes the most extensive periodical index in existence today, the *Current List of Medical Literature*. The current list appears monthly, and its subject and author indexes are cumulated semiannually. It has a circulation of 4,500 copies.

A published *Catalog* appears annually and is cumulated quinquennially. It lists by author and subject the books added to the collections.

The *Bibliography of Medical Reviews*, an experiment undertaken in 1955, contains citations for the review literature of medicine which appeared during that year. A second edition is in preparation covering the review literature of 1956.

A series of occasional long bibliographies on topics of current interest has been published since 1950. The most recent example is a study on cancer chemotherapeutic agents, prepared in cooperation with the National Cancer Institute, Public Health Service, now in press as a supplement to *Cancer Research*.

About 15,000 interlibrary loans and about 100,000 photoduplicates are made yearly as an extension of the library's services to other libraries, institutions, and to those users who cannot consult the collections in person. Each month the reference staff answers about 1,000 questions received by mail and over the telephone. The staff numbers more than 200 persons, including several physicians, chemists, and other specialists in the biological sciences. In response to the nature of the literature acquired, the staff embraces an unusually wide range of language competency.

The library has long since outgrown the old red brick building, next to the Smithsonian Institution, into which it moved in 1887. Since 1942, the oldest part of the collection, some 40,000 volumes of its most valuable materials, have been shelved in Cleveland, 400 miles distant from the government agencies which most use the library's facilities. Additional stacks recently built into the old building will provide for the library's needs only for about 2 more years. More than 50 years ago Dr. Billings was saying that "the library is in urgent need of shelving for its additions, some of which are being stored on window sills or on the floor."

In giving a new status and name to the National Library of Medicine, Congress has authorized the construction of a new building on a site to be selected by the Surgeon General at the direction of the Board of Regents. Funds for architect's plans have been appropriated.



# The National Library of Medicine

THE Armed Forces Medical Library has been transferred to the Public Health Service and is now operating as the National Library of Medicine.

Although as early as 1876 the library was called the National Medical Library on the title page of one of its publications, the designation did not become official, and the national character of the library was not legally recognized until 80 years later. On August 3, 1956, President Eisenhower signed the act (Public Law 941) of the 84th Congress establishing the National Library of Medicine "to assist the advancement of medical and related sciences and to aid the dissemination and exchange of scientific and other information important to the progress of medicine and to public health."

The transfer, observed with ceremony on October 1, 1956, involves the largest collection of medical literature in the Western Hemisphere and one of the largest research libraries in any special subject field. Colonel Frank B. Rogers will continue as director of this institution.

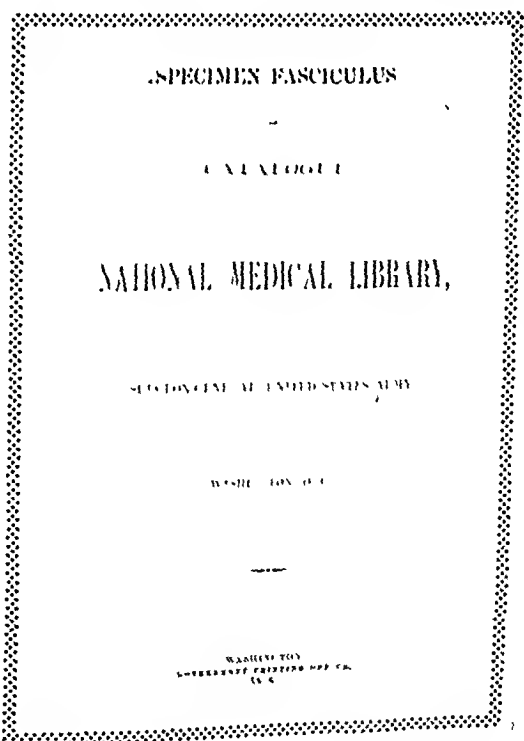
The act places the library under the Surgeon General of the Public Health Service. On matters of policy, scope of collections and services, and the rules under which the facilities of the library are to be made available to users, the Surgeon General will be advised by a 17-member board of regents, 7 of whom will serve ex officio. In addition to the Surgeon General, these are the Surgeons General of the Army, the Navy, and the Air Force, the Chief Medical Director of the Veterans Administration, the Assistant Director for Biological and Medical Sciences of the National Science Foundation, and the Librarian of Congress. The 10 other regents will be appointed by the President from the fields of medicine, library science, or public affairs.

Now entering its 121st year, the National Library of Medicine was founded as the Library of the Surgeon-General's Office (United States Army) in 1836, when Andrew Jackson was

finishing his second term as President. It was a time when the heroic therapeutic measures of men such as Bard and Rush were beginning to fall into disrepute. It was the time when Beannout in the United States and Hodgkins, Addison, and Bright in England were ushering in a new era of medicine.

In those early years the library was little more than a few shelves of books. The manuscript catalog of 1840 listed only 228 volumes. The library grew slowly until after the Civil War. Then two things happened: It received a large sum of money remaining from wartime hospital accounts, and Dr. John Shaw Billings was named librarian. With tireless energy and determination, he began to amass books, reports, transactions, and periodicals from all over the world.

By the end of his 30-year administration, the library's collections had increased from 2,000





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# age

The following pages carry material selected for its relation to a single theme: the responsibility of the health professions for the aged population, identifiable less by their years than by their needs. Comments on public health programs for the aging are offered in the leading statement by Surgeon General Leroy E. Burney.

Trends in gerontology and several of its aspects are covered in five papers from the research seminar held at the University of Michigan Conference on Aging at Ann Arbor, July 1956. Reports of other sessions at that conference follow.

Certain recommendations of the first Federal-State Conference on Aging, held in Washington, D. C., in June 1956, are published for their particular value to public health agencies.

Included in the section are two privately contributed reports. Dr. Pemberton and Dr. Macleod assay the health status of a group of men over 40 in a rural area, and Mrs. Belloc reports on eyesight in the aged.

## *Selected Papers of Joseph W. Mountin*

By E. G. McGAVRAN, M.D., M.P.H.

*Selected papers of Joseph W. Mountin, M.D.  
[Published by] Joseph W. Mountin Memorial  
Committee. New York, American Public Health  
Association, 356 pp. Price \$5.*

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THE PUBLICATION of "Selected Papers of Joseph W. Mountin" by the Memorial Committee is perhaps the finest memorial and tribute possible to a great public health man.

In this historical document, students and scholars of public health can see clearly the phenomenal growth of public health in this century.

Beautifully planned, organized, and edited, the book holds great value for the careful reader or the skimmer. Each chapter, and frequently each paper, is accompanied by editorial comment and quotations that highlight that particular subject matter. Key words, ideas, and concepts throughout the multiplicity of subject matter stand out and give emphasis through repetition to the character of the author. These are things Joseph Mountin felt to be important in public health. These are the things that made him a public health statesman, ahead of his time but with feet solidly upon the ground.

Each reader may pick for himself the threads that run consistently throughout the fabric of these papers. For example, there is the thread of change: "divine discontent with the traditional, with past or present performance and concepts . . . public health as a dynamic moving force in a changing social order, an emerging science . . . changing concepts . . . changing patterns . . . adaptation to meet the changing needs . . . adjustment to meet new situations."

It is popular today to include gerontology in our list of public health responsibilities, but Dr. Mountin set down forcefully years ago

what our responsibility for how we may go about meeting it. He warns us of the danger of forming to the "orthodox" principles of health—"How free we seem; how free we are"—but advises that we study seriously the health needs of our community so that we may promote and conserve its health more efficiently. This is the spirit of scientific inquiry, the spirit of scientific freedom, that is the best minds in any profession.

A prominent thread is Dr. Mountin's concern for the future of public health. Glaring through the titles of his papers: "Planning for Public Health," "The Evolving Pattern of Tomorrow's Health," "The Future of Public Health Nursing," "Organizing for the Newer Public Health Programs." It is not enough to consolidate our gains, to live on past accomplishments, to hold the line. We must be pushing back the frontiers of knowledge in community health, our distinctive area of competence. The "pioneering spirit" is what is needed, and that spirit requires courage—courage, conviction, and dedication of a high order—for pioneering in health today is more adventurous than was the land pioneering of our forefathers, for we live in the wealthiest and therefore the most conservative nation upon the face of the earth. Dr. Mountin's papers demonstrate this courage as his life demonstrated its dangers. Note the weight he constantly places upon trends, the scientific prognosis of what the future holds for us in health status, health needs, problems, and opportunities.

Another thread is evaluation. Dr. Mountin does not discard programs and activities because they are traditional, but he does emphasize evaluation—constant critical analysis of any program, old or new, to determine its effectiveness, and exploration and research in administrative methods to see if there is a better way to meet community needs. He is not satisfied with scientific diagnosis, prognosis, prescription, or treatment of community health problems. He wants constant scientific supervision and followup. This is the spirit of a great public health physician whose concern is for his patient, the community, and not merely the science of his profession of public health.

in their homes. It has been done, here and there, by the Allegheny County Institutional District in Pennsylvania, at the Goldwater Memorial Hospital in New York City, and at the District General Hospital in Washington, D. C.

The health maintenance clinic is no longer a pipe dream. This idea for the improvement of adult health is being applied in the University of Miami Medical School and, limited to recipients of old age assistance, by the Santa Cruz County Health Department in California. In New York City and Worcester, Mass., medical societies, health departments, and voluntary agencies are experimenting with "well-older conferences." They say the "well oldersters" don't object to the obvious "well baby" comparison, quite the reverse. Equally sporadic is the development of adequate home care programs; yet, 90 percent of the disabled 65-and-over group is at home. Almost untouched is the quality of care in nursing homes; yet, many State health departments are responsible for the licensing of such facilities. So, also, is the idea of cooperative services to the chronically ill and aged in which many community agencies, voluntary and official, participate.

Are we, the appointed guardians of public health, going to remain content with piecemeal services for the increasing millions of older people? We in the Public Health Service are going to give this problem top priority in our program planning. We have already taken some of the steps. We shall take others, assign more personnel, cooperate with the States to the fullest extent of our available resources.

I wish to add one caution. Public health

practitioners and private practitioners are not miracle workers. I fervently agree that some of the improvements we could make tomorrow, with relatively simple means, might seem miraculous in their beneficial effects on the lives of many older people. But the social, economic, physical, and emotional problems of growing old in our society are complex and difficult of solution. No efforts on the part of public health and medicine to improve the health of the aged can be fully successful unless society is willing to make parallel efforts in related fields. We cannot be all things to all men. So let our planning for health of the aged be predicated upon the following assumptions:

- That continued efforts will be made to improve financial security of our older citizens.

- That parallel efforts will be made to remove arbitrary restrictions on the employment of individuals because of chronological age.

- That there will be no diminution in the Nation's current medical research effort, leading to more effective health care and control of chronic disease.

- That existing health and rehabilitation programs be sustained and progressively expanded so that maternal and child health services and other preventive and restorative programs may assure oncoming generations a foundation of better health as they reach old age.

- That the concept of Federal-State cooperation and of working together with the professions and the public will continue to inform and inspire all that we do for the better health of the aged.





# Programs for the Aged

By LEROY E. BURNEY, M.D.

*The Surgeon General's address at the banquet for the State and Territorial Health Officers, November 8, 1956, Washington, D. C., was climaxed by the following strong appeal for programs for the aged.*

. . .

IT IS IMPORTANT that the public health profession develop swiftly some mutually acceptable principles upon which to base our planning in the vital and inseparable fields of aging and chronic illness.

If we do not institute constructive action to improve the health of the aged and reduce the burden of chronic illness in more communities and States, we will have failed in our plain duty to the people we serve—and that is the whole community not merely a certain segment.

I speak bluntly for the good reason that, at national and State levels, the problem of aging has become a matter of public policy with a high priority for action. It has grown over the years until now it has come to a head, presenting all the classic signs: rubor, calor, dolor, and tumor. Unfortunately, the signs of heat and irritation are observed chiefly in public and private deliberations on how to solve the problems of aging while the aged individual and his family continue to suffer the pain and our national economy, the swelling. Our communities, States, and Nation want some practical, feasible means of treatment.

As physicians and health specialists we can expect to be called in consultation. Are we prepared to give sound advice on what should be the next steps for improvement in our own field, health of the aged?

Health is a central factor in every aspect of the older person's life. It cuts across every social, occupational, and economic line. It affects every proposal for improving the lot of older people in family life, employment, recreation, and participation in community affairs.

A few specialized programs have been initiated in the past decade which, it is true, are directly related to the health of people in the fifth and succeeding decades of life. I refer to community mental health services and tuberculosis, cardiovascular disease, and cancer control. The earlier venereal disease control program also is directly related to adult health. Even if these specialized Federal-State programs were at this moment operating at peak effectiveness in all parts of the country, they could reach only a fraction of the disabilities seriously affecting the adult population of middle and later ages.

And I should be less than candid if I did not say, here and now, that our existing specialized programs reach pitifully few of the men and women who need them most: the aged. As a candidate for that category, I have a personal sense of misgiving when I realize that the age groups which have the shortest remaining life expectancy also receive the short end in health and related services. Yet, there is so much health departments could do now if they had the resources and the vision. We simply haven't begun to apply the knowledge already available.

In terms of national health and national economy, there are incalculable savings to be made through restoration of bed-bound, institution-bound older people at least to self-care

blood vessels of the uterus may even tend to lose their calcification, which was due to arterial strain. It has been demonstrated that the mental response of a patient may be improved, that such things as memory, ability to coordinate thought, judgment, and the like, may be benefited by therapy. We can say that the biological function and physical tissue may be modified and that they parallel one another. This phase of gerontology needs much research, and much may be accomplished by proper study and evaluation.

Can and should these changes be modified? From my limited experience I feel that knowledge will lead to a definite modification of tissue and its function, which will in turn extend the health of older people. Many of the diseases found in older people are attributed to arteriosclerosis, but since the advent of pathology physicians have found that a clinical diagnosis of arteriosclerosis is not always substantiated by autopsy findings. Children died of diarrhea, which was later found to be preventable by control of the nutritional state of the infant. The trend in biological study is upward, but the ascent is very slow.

### Psychology

There are so many factors that influence the psychology of the older person that it is difficult to evaluate them briefly. The need for a better adjustment of the older person to his environment, the need for economic, social, and medical security, all enter into the mental and emotional disturbance of his existence. Control of these factors leads to a healthier outlook on life, to a better understanding of the emotions, and must come through proper education of the individual and a realization on his part that aging is not something to be shunned, but something to be accepted and adjusted to. As most of our youngsters are taught, so should our oldsters be taught that they must prepare themselves for the future in order to have a pleasant corner in life at any age.

There is an increasing realization of the need to develop this thought. I can point particularly to the University of Michigan, which has taken the lead in the control of the psychological aspect of older people. This institution is

well known for studies concerning the mental health, the emotional needs, the adjustment to an industrial program, and the education of the older person. Proper thinking in the field of psychology of the aging by the leaders is well assured. Administration of this thought to those who need it is, of course, difficult. It must come with education of the masses of older people. The trend toward proper evaluation in the field of psychology is strong.

### Clinical Medicine

Clinical medicine has for generations shied away from the subject of gerontology and is still doing so. Few medical schools teach any of its principles. Few of the teachers in the schools realize its importance, and consequently few teach medical students and interns the problems of aging, particularly the anticipation of disease. They sack up most diseases that occur in older people and call them arteriosclerosis and shake their heads and say: It is inevitable. There is an awakening of thought in the direction that some of the changes that occur with age may be modified and that basic underlying changes which lead to the diseases of the older person may be recognized and treated. However, the problems of geriatric medicine have not yet received proper recognition.

The trend in clinical medicine is a sort of status quo. Many clinicians still think that illness must occur with age. Since they feel that a disease must occur before treatment is started, they are unable to approach the prophylaxis of gerontology. They are unwilling to anticipate that illness may occur unless something is done to direct and control the body functions. It is important to emphasize that acute phases of chronic disease do not occur suddenly; rather they progress slowly and have their existence as a result of changes that began long before the acute phases developed. Internal medicine needs to take a page out of the book of pediatrics from the standpoint of prophylactic and anticipatory medicine.

Nevertheless, the clinical state of the older patient has been much improved. Many types of conditions that frequently lead to chronic diseases are now controllable. For instance,



# Trends in Gerontology

By WILLIAM B. KOUNTZ, M.D.

**WHAT IS GERONTOLOGY?** We might say that it is an understanding of the process of aging, or a form of therapy, or a form of evaluation of the problem of aging. All these are true in their own way, but, actually, gerontology is a cumulative process of thinking in regard to one of the important problems of existence. Gerontology is indeed a broad word, covering many facets of our existence.

Much like medicine itself, gerontology had to create a logical place in the human mind before it could be established. Since thought develops slowly and in stages, the most critical point is usually the one considered first by the mind. Because of the need, generations ago, for attention to the health of the younger individual, the problems of the early years of life were attacked most vigorously and the science of pediatrics was established. It was only after the application of this direction of study and observation of the results that the problems of the period past midlife became critical in the mind of man. We are now at the stage where gerontological control in all its different phases and aspects looms high as one of the greatest needs of mankind.

Since gerontology is divided into different units, or disciplines, we shall consider each one separately.

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*Dr. Kountz is assistant professor of clinical medicine, Washington University School of Medicine, St. Louis, Mo.*

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## Biology

Since there is definite biological change in everyone from his unicellular state to maturity, the biological problem is important not only in the period of growth and development, but also in maturity and later years. In considering the biological aspect of aging, there are a number of questions that must be asked: Is the body as it ages fixed in its principle so that the changes cannot be modified? Should we expect biological change to be comparable to the process of boiling an egg? Can such anatomical and functional changes as occur with age be modified?

These questions have been answered definitely. It has been shown that there may be a reversal in the picture of tissue, both biologically and functionally, long after the tissue has ceased its normal activity, that actually the functional capacity of the tissue may be returned to near normal and the biological appearance of the cells and tissues may again approach that of younger periods of life. Since this can be demonstrated in certain tissues, it is highly possible that other tissues may be modified in both their functional capacities and anatomical appearance.

It has been shown that the epithelium of the nose and throat may again develop cilia and that an improvement of this tissue may occur after the functional capacity of the mechanism has been greatly reduced. It has been demonstrated that the endometrium of the uterus may be returned to a state resembling its former state in anatomical appearance and even, in part, in function. With proper therapy, the



# Psychological Limitations That Occur With Age

By JAMES E. BIRREN, Ph.D.

THE PURPOSE of this paper is to describe a few limitations that may occur with age and to draw some preliminary inferences about the underlying mechanisms. The scientific literature on the psychological aspects of aging is increasing. The contributions from the Cambridge Laboratory in England (1-4) and the publications of numerous investigators in this country have given us many facts to digest. Recently, reviews have appeared on special aspects of aging, such as psychomotor changes, changes in mental abilities, and changes in personality (5-7). Many summaries of the literature were presented at the Bethesda Research Conference on the Psychological Aspects of Aging (8). With this factual background in mind, it is proper that we begin to consider some of the general mechanisms which may underlie the psychological limitations of aging.

It is implicitly assumed that from considerations of basic facts and information suggestions will become apparent for the prophylaxis and alleviation of many of the limitations which occur with age. Because we use the term "limitations of aging," it should not be assumed that aging is inevitably linked with limitations. The advantages associated with advancing age, like those of growth, take care of themselves, but

limitations and defects do not. To these we must direct the knowledge of our sciences and professions if we are to increase the number of healthy, happy, informed, and independent older persons.

## A Point of View

There are two psychologies to be considered in relation to limitations of aging. One is clinical and is concerned with diagnostic, therapeutic, rehabilitative, and supportive procedures. The other is directly concerned with research or experimentation on mechanisms of aging. The point of view adopted in this paper is that of research. We are seeking explanatory principles that might begin to link the now disparate facts about aging.

## *Generalization vs. Individual Differences*

For many psychological and biological processes, about 50 percent of the variation in the data is explained by the general age trend. Thus, in many studies, the range of individual differences is about equal to the magnitude of the mean trend. Whether we emphasize the general trend in our psychological or biological data or the range of individual differences depends upon our purposes. The clinician is more often interested in the uniqueness of the individual under study than in the general characteristics he shares with other people. The biologically minded psychologist is more often concerned with an analysis of the general

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*Dr. Birren is chief of the Section on Aging, Laboratory of Psychology, National Institute of Mental Health, Public Health Service, Bethesda, Md.*

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hypertension, or high blood pressure, has been brought under control to a great extent in the past few years, a fact that will doubtless help to prevent illness in many oldsters. The understanding of dietary problems, such as the influence of fats in the control of arterial disease, and the understanding of the nutrition of the body likewise play an important part in the control of chronic disease. Surgery, with its ability to replace diseased blood vessels, leads to improved health in the older person. The early recognition and surgical treatment of cancer of the breast, the uterus, and the lung also help to extend health into the later years of life. And much could be said about the introduction of medications and techniques in specific disease, all of which lead to better health.

The trend in the clinical aspect of the control of disease in older people is definitely upward, but there is still need for earlier recognition and earlier clinical evaluation before prevention of disease can come into its own. The treatment and control of disease in older people has been much improved, and the trend to better health is a trend to a brighter outlook.

#### Other Aspects

The social, economic, and religious aspects of life for older persons vary a great deal from these aspects of life for young people. The social aspect is often modified by a change in

clinical health, in economic ability, and particularly in the psychological outlook of older individuals. That social needs should be recognized and social adjustment aided there can be no doubt. The trend is in this direction: for example, social security, old age pensions, and housing projects for the aged. Fraternal organizations and other groups are beginning to make moves toward meeting the needs of their retired members. In my experience the social aspect is always conditioned by psychological and clinical health. Those in poor health need social adjustment and social help; those in good health maintain their own level.

Another trend of great importance is the increasing concern among lay people with the results of gerontological research. If properly directed, their interest can speed the progress of gerontology. It will serve to create a demand on scientists and physicians to develop the knowledge necessary to assure health in the later years. This emphasizes the need for the formation of foundations to help develop further study and to establish funds for research, as well as to permit the expression of lay people in the field. This type of organization enables the layman and the scientist to become partners in gerontological research, and no more important a relationship can be established. One such organization, the Gerontological Research Foundation, has already been set up.

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### Directs Program on Aging

William C. Fitch, of the Bureau of Old-Age and Survivors Insurance, has been named director of the special staff on aging, a newly created post in the Department of Health, Education, and Welfare.

Mr. Fitch, who began his career in 1937 as assistant manager of the Kingston, N. Y., Social Security District Office, was assistant to the director of the Bureau of Old-Age and Survivors Insurance prior to this appointment. He was a member of the Department's Committee on Aging and consultant to two of the annual University of Michigan conferences on aging. In September 1956 he returned to the United States after serving for a year as social insurance adviser to the Government of Israel.

The special staff on aging represents an expansion of the Department's program on aging. Clark Tibbitts will continue as chairman of the Department's Committee on Aging, established in 1950.





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characteristics. Both the general trend and the range of individual differences are proper subjects for study.

### *An Emerging View*

As individuals, we are continually concerned with an emerging point of view toward human aging, that is, the proper combination of generalizations with specific facts from personal experience. At some point the experimenter joins with the clinician and with informed people in general to give an appropriate weighting or perspective to the facts of psychological limitations in aging. But what facts should be emphasized? Should we emphasize that there appears to be a disparity between the observable anatomical changes of aging of the nervous system and the changes seen in individual behavior and personality? If this is emphasized, we encourage acceptance of or complacency about our lack of knowledge concerning the relations between psychological functions and the structures of the nervous system. It does not appear to be sound mental health to encourage the idea that successful aging is entirely a voluntary phenomenon and that all older people are capable of doing outstanding things if they would only try. The mature point of view toward human aging seems to represent a balance between optimism and realism and an avoidance both of excess voluntarism and of undue stress on the limitations of aging.

### **Speed in Timing in Human Behavior**

Perhaps the most significant result of research on age changes in the nervous system in the past 10 years is the implication that there is a general slowing of all voluntary responses. In a previous review it was pointed out not only that the slowing of voluntary responses with age is an overt manifestation but also that there is evidence of slowing of covert responses in aging, such as speed of associations of thought (9). The change in response latency appears to be our most fruitful point of departure for exploring the nature of age changes in behavior and perhaps for the significance of the age changes in the structures of the nervous system.

In young adults individual differences in

speed seem to have only limited psychological importance. In aging, however, individual differences in speed or response latencies seem to be an important independent variable for the psychologist to consider. Recent research suggests that the time delay between stimulation and response is primarily a property of the central nervous system, whereas earlier research tended to minimize the importance of time differences that might be observed in simple and choice reaction time measurements. The slowing with age has to some extent been viewed as an arbitrary or artifactual aspect of performance of the older person. Implicit in such a view is the assumption that the slowing occurs only in the response or output mechanisms and is unrelated to the speed or the quality of events preceding the initiation of response. Were the loss of speed with age a peripheral phenomenon, it would of course be of limited psychological interest.

Simple speed tests seem to differentiate more clearly between senile psychotic individuals and control subjects than do various combinations of rather complex mental tasks. For example, a 2-minute writing test was found to differentiate senile patients and control subjects (10). In contrast, a 1½-hour psychometric test designed to measure deterioration did not yield such differentiation. Again, later studies showed that this difference was not simply a peripheral limitation on the writing speed, but that the speed of writing was correlated with the probability of the antecedent events being correct (11).

What requires the additional time in the older nervous system? Does a timelag occur in the retina or in the optic nerve? Is there an increased latency in the primary sensory projection area of the brain or in an association area? Is additional time required in programming appropriate motor responses in the motor cortex or in the spinal cord? Does the peripheral nerve or the myoneural junction require more time in its functions?

It was originally thought that older people adopted a slow tempo of response. Hence the increased latencies of voluntary responses were not viewed as a reflection of reduced capacities of the nervous system but phenomena of attitude or set. It has now been shown that at

least in one other species, the rat, a slowing of response latency occurs with age. In a recently published study of startle responses of rats of different ages, it was shown that for older rats there is an increase in response time to electric shock and to sudden noises (12). Furthermore, when attempts were made to decrease the response time of these animals by increasing the electric shock, a minimum reaction time was reached beyond which a further increase in the stimulus strength did not result in a further reduction in reaction time. At this plateau, or asymptotic level, of response, there was a residual difference between young and old animals.

An experimental attempt was also made to see to what extent the slowing with age could be related to conduction velocity of peripheral nerve in the rat. In this study the conduction velocity was measured in isolated sciatic nerve excised from more than 75 rats ranging in age from 50 to 850 days (13). Conduction velocity increased during development, but it did not change significantly after about 300 days. The results of that study taken together with results of previously reported studies indicate that changes in peripheral nerve do not appear to be important in the changes which we see in such functions as simple reaction time in later life (9, 14).

Recent and unpublished studies by Dr. Alfred Weiss of the National Institute of Mental Health and by Dr. Botwinick, also with the institute, and myself have found no evidence as yet that the age changes in the speed of human voluntary response to any large extent lie in either the receptor or in the effector processes. An earlier study by Johannes Sommer indicates that the age change in a simple spinal reflex in the human is small; it seems to be of the order of perhaps 1 millisecond compared with the 50 or more milliseconds that differentiate the voluntary responses of a young and an older person (9).

The recent work of Kumnick on pupillary responses to light indicates that under some circumstances the latency is unchanged with age. This implies that at least under some conditions the rapidity of all the events, from the stimulation of the receptors in the eye to the effecting of pupillary constriction, must be

unchanged with age. Apparently, the older pupil constricts at a normal rate in proportion to its smaller size. Since the older pupil is usually somewhat smaller, it may, however, give the illusion of a slower response. If this rather complicated reflex remains unchanged in later life, we might speculate that some of the purely sensory components are also unchanged in relation to latency of perception and the initiation of voluntary responses.

Apparently, the decrease in speed of voluntary responses with age is primarily a phenomenon of the central nervous system and conscious behavior. This provokes a dilemma because the physiological methods which might be appropriate to a study of the phenomenon are ones which are so artificial (for example, anesthetizing the organism) that they preclude studying manifestations in the conscious state. The problems lie in an experimental area wherein the relevant types of experimentation and variables are familiar to the experimental psychologist, and the inferences lie in the domain of the neurophysiologist.

A depressed person might respond slowly and yet retain a capacity to respond quickly, whereas it is extremely doubtful that the older organism maintains the capacity for rapid response. Responses of the elderly are made at some uniformly slow rate (15). This suggests that we might speak of less "temporal modulation" of voluntary responses. Implications of this concept are important in attempts to define the environment wherein the older person would be most comfortable. In general, the older person is most comfortable in a situation in which he can pace his responses and is least comfortable in one in which he must respond quickly to demanding sequential stimuli. Rapid sequential stimuli occur, for example, in automobile driving. This situation is not revealed satisfactorily by an analogy to a simple reaction-time experiment. Recent findings in our laboratory show that there is a difference in readiness to respond in the elderly as compared with the young. Different age curves were obtained for changes in response time as a function of preparation. It is not possible to say at this time whether the lower level of response readiness or expectancy is independent of the increased latency or is a different mani-

festation of a common underlying change in the character of nervous system functioning. Also, we do not yet know whether complex tasks merely show a multiplicative effect of the longer latencies. Again it may be that the same basic process is simply disproportionately represented in a complex situation.

### Serial Movements in Timing

There is evidence that one of the limitations older persons face is difficulty in timing sequential events. Kay pointed out that his learning experiments suggest that with advanced age some individuals display a difficulty in "programming" sequential movements (1). This was noted also in earlier work on age changes in handwriting. In some aged individuals handwriting tends to become a series of discrete movements, instead of a smooth, overlapping of movements, that is, it becomes more like drawing. This is analogous perhaps to a change in a feedback mechanism wherein the older organism is unable to use the information obtained from the execution of a preceding movement to modify a following one or is unable to do so with sufficient speed. Singleton pointed out that the speed of movements, once the movements are initiated, is unchanged in older persons. What requires additional time with age is the decision points in movements (2).

For optimum skill, the proper moment for initiating responses must be anticipated. Components of serial responses must be programmed in advance to conserve time. If the response components are not anticipated or programmed they appear as discrete events separated by delay intervals. A slowness in developing or programming future responses may limit the aged in the execution of some highly complicated skills, the essence of which is the flowing of activities or movements one into the other. It is perhaps highly relevant to note that, when a skill is first acquired, the component movements appear discrete and that, as the skill is improved, these movements are gradually combined into a continuous pattern. As a skill deteriorates, it may again assume the quality of separate movements. Timing seems to have a perceptual character, that is, one sees or feels the right moment to make a response. Difficult

conditions exist when the signals come close together.

In the preceding remarks, the facilitation of voluntary response was emphasized. However, in the aging nervous system there may exist a general change in excitability which would be reflected in both facilitatory and inhibitory functions of the nervous system. Perhaps more common in daily life than a demand response to a stimulus is the situation in which the stimulus may be anticipated and received in advance of the appropriate moment for the response. Good timing may thus be more a matter of inhibiting the response until the proper moment than a matter of its facilitation. In aging there may exist a narrowing of the range between minimum response time and maximum response time. This topic requires more information than now exists about the length of delays which can be interpolated between sequential stimuli without the behaviors disintegrating or being forgotten.

Viewed from one aspect, the nervous system appears to be more determinate in the aged than in younger persons, that is, the output tends to be more directly a function of the input. There is, of course, a tendency to cultivate certain types of determinacy or redundancy, as in the social graces. It is of interest to note that the social facade may be the last bit of behavior to disintegrate in the senile individual. Our psychological data on aging should be sifted for influences of our cultural pattern that determine which areas of our behavior may be novel and which are expected to be predictable.

### Perceptual Difficulty

Perceptual difficulty, or inability to perceive information in order to achieve an appropriate response, may contribute to the age changes in behavior. One experiment attempted to see to what extent the response time of old and young people would vary as a function of perceptual difficulty (16). Young and elderly subjects were required to judge which of two simultaneously presented lines was the shorter. The lines were presented tachistoscopically. Each subject made a minimum of 48 judgments in a series of line pairs which differed in length from 1 to 50 percent. The subject was required

to respond as quickly as he could when the lines were presented by saying "right" or "left" to indicate the side of the shorter line. The vocal response of the subject interrupted a chromoscope circuit, and his response time was measured to the nearest one-hundredth of a second. A significant difference in response time between the two age groups was found at all levels of difficulty of judgment. The response time of the elderly was relatively longer, however, when the stimulus difficulty was increased. Thus, the difference in response time between the young and the elderly subjects was 0.47 seconds at a 1 percent difference in line length, whereas for a 50 percent difference in line length the response time of the young and older subjects differed by 0.18 seconds. It is apparent that perceptual difficulty can contribute to the slower response of elderly subjects. However, there is a residual age difference in response time which exists regardless of the ease of the perceptual task involved.

Again, one might question whether a large part of this difference in response latency is not due simply to the difference in speed of vocalization. For this reason we conducted another experiment in which we studied age differences in finger, jaw, and foot reaction time to auditory stimuli (14). The hypothesis was that, if a general factor were underlying the age change in response latency, we would get a constant increment in reaction time with the jaw, finger, and foot. If the age changes were primarily involved in the peripheral pathways, then the reaction time with the foot with its long pathways might be disproportionately slow as compared with the finger or jaw. In this study, the reaction time of the elderly subjects was significantly slower than that of the young subjects for the finger, jaw, and foot, but there was no relation to the length of the peripheral path involved. Since the age differences between the reaction-time means did not change significantly in comparing the finger, foot, and jaw, it may be concluded that the age change in reaction time is not a variable associated with the length of the peripheral path. Collectively, the evidence suggests that it is plausible to regard the age change in response latency as a general property of the central nervous system.

## Summary

For many psychological and biological processes there is a general age trend which in some instances explains about 50 percent of the variation in the data. There is an equally large range of individual differences. It depends upon our purposes whether we study and emphasize the general age trend or the individual differences in aging. Both the general age trend and individual differences are important.

Perhaps the most significant result of research on age changes in the nervous system is the implication that there is a generalized slowing of all voluntary responses. On the whole, the evidence indicates there are grounds for regarding the age change in response latency as a general property of the central nervous system. The longer response latencies appear to have their greatest consequence for complex or serial activities. The facts offer suggestions for further research into the bases of the changes, as well as for structuring the environment in order to reduce problems of living due to the psychological limitations of aging.

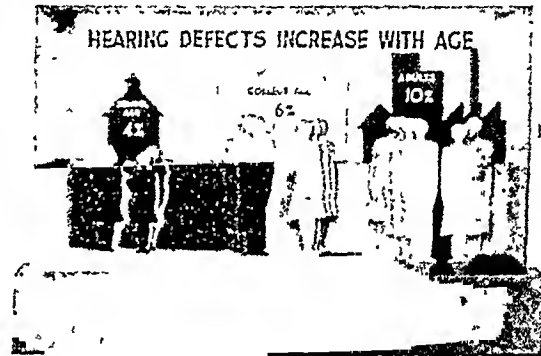
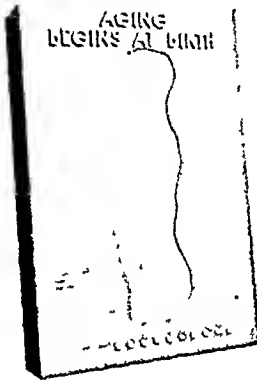
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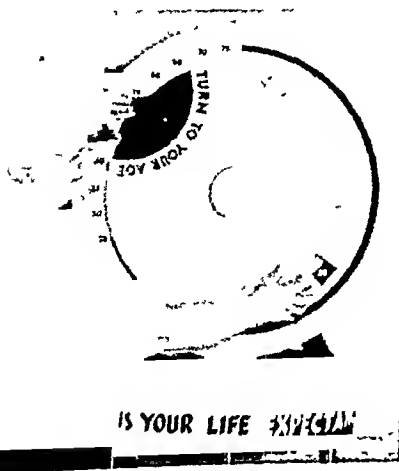
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## Making Health Visible

Among the exhibits and other educational materials offered by the Cleveland Health Museum in its catalog, "How to Make Health Visible," three illustrated on this page are among those which particularly concern the subject of age. One is a device which permits visitors to learn the average life expectancy, according to present mortality tables, for their age and sex. Another illustrates the point that aging begins with mitosis. The third illustrates the gain in hearing deficiencies with advancing years.





# Changes in Nervous System With Age

By HARRY H. WILCOX, Ph.D.

THE NERVOUS SYSTEM is unique and its basic cellular structure is very highly specialized and diversified. The individual nerve cells in one small circumscribed area or nucleus may be markedly different in structure, action, and reaction from those neurons that form an adjacent group. These neurons, even with their many unsolved problems, are far better known anatomically and physiologically than the greater bulk of the nervous system, their supportive structures. These structures, including the glia and the ground substance, are within the bounds of the existing frontiers of neuroanatomy and neurophysiology. So much of the normal picture of the nervous system is so scantily known that departures from the normal are at best determined with difficulty.

A host of neuroanatomical alterations in the nervous system accompanying the process of aging have been described. Many of these so-called manifestations of aging occur in the very young as well as in the old. Some of these, when they occur in the young are undoubtedly abnormal, whereas the frequency with which they occur in the old might cause them to be labeled as normal alterations accompanying aging. Aging should be looked upon primarily as a physiological stage and not a pathological condition. The normal alterations that bring about or occur with the gradual and continual advance from one plateau of life to another are apt to be quite subtle. They therefore are dif-

ficult to determine or locate accurately, and difficult to separate from abnormal changes brought about by modifications in internal or external environmental conditions as influenced by disease or trauma. The separation of these changes from artifacts or post-mortem changes, often uncontrollable in human material, cannot be overemphasized.

In human peripheral nerves it has been shown that there is an increase in connective tissue and a reduction in the patency of the blood vessels (1, 2). This begins in the fourth decade of life as an endothelial proliferation and hyalinization of the vessels with an increase in the endoperineurium invading and apparently replacing areas of the nerve bundles by connective tissue elements. With this gradual reduction in blood supply and increase in connective tissue, there seems to be a gradual alteration and reduction of the nerve fibers, especially the larger ones. These findings parallel the measurements of the conduction velocity in human nerves (3) which indicate that, beginning in the fifth decade of life, there is a slight but continual decrease in conduction velocity. Again the responsibility may be placed on a decreased vascular supply due to a local ischemia and changes in permeability of the vessels accompanying metabolic depression.

The conduction velocity of peripheral nerves in the rat (4) markedly increases during development, with a leveling off at maturity. In contrast to findings of the human studies, little change in conduction velocity was noted in rats after maturity was reached.

Counts of fibers in the dorsal and ventral roots of the eighth and ninth thoracic levels, as

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well as cell counts of those dorsal root ganglia, taken from human cadaveric material (5, 6), indicate a marked decrease in both number of myelinated fibers and cells after the fifth decade of life. However, in view of the rather wide range of variation within the relatively small groups of similar ages in these studies and the degree of overlap between groups, additional studies of this type are needed to substantiate the existing evidence.

Certainly, if in the normal course of aging, the metabolic activities of peripheral nerves are so disturbed as to produce a marked numerical decrease in the components, the effect on the normal course of the processes of degeneration and regeneration might be quite marked. One study of the effect of age on wallerian degeneration in the rat was carried out on fairly young animals (7). In this study it was demonstrated that in young animals there was a more rapid cellular proliferation and a less rapid loss of myelin than in older animals (160 days of age). Another report (8) demonstrates that in older animals more general and extensive signs of retrograde degeneration were present than in young animals, with a striking increase in the number of macrophages present in the sectioned dorsal roots of the older animals, but with a slower rate of removal of debris. This might be due to a lower metabolic rate, although it is not entirely in keeping with the findings of a comparable nerve fiber regrowth rate as evidenced by similar numbers of regenerating axons distal to the anastomosis. In the older animals, there was a diminution in the number of fibers successfully crossing the scar and in the rate of growth beyond. The proliferation of capillaries in the anastomosed roots of the senile rats was quite impressive.

### Ganglial Degeneration

Cells of the dorsal root ganglia and the gasserian ganglion in the human, as well as in cats and rats (9, 10), undergo a fatty degeneration which consists of a clumping of the Nissl substance, a subsequent destruction of the neurofibrillar reticulum, and a coalescence of the vacuoles. The cell becomes quite foamy and swollen and finally is destroyed, leaving behind only cellular debris. Although cell counts made on

this material indicated no marked difference between young and old individuals, the numbers were relatively small, and statistical measures could not be applied to test the data. Atypical cells, such as the frayed cells of Cajal, fenestrated cells, cells with end bulbs, and so on, seemed to occur commonly in these ganglia at all ages.

Degenerate changes in occasional cells with a moderate degree of neuronophagia have been reported in human autonomic ganglia, with an increase of the interstitial tissue of the ganglia (11), as well as variations in the chromidial substance, shrinkage, hyalin degeneration, hydropic alterations, pigmentation, nuclear displacement, vacuolization, and partial or complete destruction of the cell (12). While in dogs, many of these variations seem to be related to aging, there was some question about the correlation in man. Even pigmentation was questionable since in man apparently many factors contribute to deposition of pigment.

A subsequent study of this pigment (13) found it to be a lipofuscin type closely related to ceroids and not to melanin. It seems to be one of three materials present in the nerve cells that are periodic-acid Schiff positive. The other two are glycogen, which is found in dogs of all ages, and a mucoprotein. Lipofuscin was not found in dogs less than 10 years of age, while in man it was present in varying amounts at all ages from 7 to 92 years. The mucoprotein is limited to nerve cells of the peripheral nervous system and is present to a greater degree in the autonomic cells. It is present in all nerve cells in a granular form in both senile and young dogs but is not concentrated enough in the young animals to be demonstrated by the periodic-acid Schiff method (14). Lipofuscin has a much wider distribution and seems to be more concentrated in the efferent nerve cells.

The pigment of the autonomic ganglion cell has been considered (15) to be, or to contain, a hormone or a similar substance which represents part of the neurosecretion of the nervous system. The origin of the pigment from the Golgi apparatus has been suggested.

The variability of the Nissl pattern and of the number of cells in the chain ganglia of similar size has been shown in the rat (16) and in the guinea pig (17). The series of animals used



in these studies did not, unfortunately, include senile forms, but the series from fetal to mature stages form bases for further investigation.

No data on the effect of age on the regenerative capacity of the fibers of the autonomic nervous system exists. It would be most interesting to follow this process in senile forms.

### Central Nervous System Changes

Changes similar to those described in the ganglion cells are reported in the various areas of the central nervous system. In the spinal cord (18), the general histological structure begins to alter after 30 years of age, and by 60 years the changes are quite marked. Vascular alterations, gliosis, and demyelination, especially in the fasciculus gracilis, pigmentation of cells, and formation of corpora amylacea were among the findings. Pyknosis and chromatolysis in the cells of the ventral horn did not occur frequently and certainly were in no instance pronounced enough to be significant.

Pigmentation was such a constant finding in individuals in the fifth decade of life and older that it was felt that if pigment atrophy is considered an abnormality one could scarcely find a normal spinal cord after the age of 40 and, by the seventh and eighth decades, hardly a normal ganglion cell could be found. In some cells the change was so severe that the cell appeared as a pyknotic pigment spot. Corpora amylacea were not reported in spinal cords of persons less than 30 years of age; after the fourth decade it was a frequent occurrence, especially around the entrance of the dorsal roots.

### Changes in the Brain

Several studies indicate that the gross weight of the brain decreases with age. One of these (19), a study on 2,060 brains of white males whose ages ranged from 12 to 96 years, reported that there was a gradual increase in the weight of the brain up to 30-34 years of age, and then a gradual, uniform decrease takes place. The maximum decrease occurring between the 3d and 10th decades of life was approximately 11 percent. Accurate determination of the weight of the brain is quite difficult. It has been pointed out (20) that simple severance of the

brain, the treatment of the meninges, and the removal of the cerebrospinal fluid are rather variable factors (20). These sources of error can be minimized if one individual removes and handles the brains; otherwise, those variables must be considered in analyzing samples.

The brain size has been said to fluctuate inversely with economic level (21). Since most of the brains obtained in routine autopsy in hospitals come from persons of the lower social strata, they may not be too representative of a cross section of the total population.

The reported decrease in brain weight does not seem to be due entirely to a difference in water content. There are studies that report a definite decrease in water content in the brain throughout the entire life span (22, 23). This decrease varies somewhat with different species since there seems to be a remarkable correlation between physical and mental development at the time of birth and subsequent water loss. One report on senile human brains differs from the others in that it states that there is an increase in the water content in senile brains (24). There seems, however, to be universal agreement on the higher water content of the cortex and the lower water content of the medulla, which has suggested that the phyletically newer parts of the brain are wetter.

Phyletically different brain areas also seem to show differences in the cholinesterase activity (25). In rabbits, the medulla reached its maximum activity at 15 days and then fell 50 percent by 2½ months of age. The activity remained fairly stable after that time. In the frontal cortex and caudate nucleus, the maximum activity was reached at 18 months and then held steady. However, no general conclusions as to the correlation of the cholinesterase activity have as yet been made with senility.

Young and adult rats differ in that the adult brain contains more fat and phosphorus. In extreme age there are small decreases in fat, acid soluble phosphorus, and potassium, with an increase in sodium (23).

The cerebral physiology of the human has been studied by the nitrous oxide method to show that there is a close correlation between advancing age and decreasing blood flow with a concomitant decrease in oxygen consumption (26, 27). This decrease in oxygen availability

and consumption may be closely related to neuronal activity. There seems to be almost universal agreement that, with increase in age, there is a marked decrease in the number of neuronal elements in the brain. However, most of the observations and cell counts upon which this conclusion is based have been made on relatively small series of human brains, even on a single specimen and with known mental deterioration frequently clouding the issue. Counts on large series of experimental animals are likewise scarce.

A recent report shows a decrease in the number of cortical neurons with increasing age, especially in the superior temporal gyrus and the lower quarter of the precentral gyrus (28). Unfortunately, this study is based on a very small sampling of a remarkably variable population. Variability is immediately apparent when one examines the raw data presented by the various investigators.

Only by the use of large samples, which in studies of this kind are most difficult to procure and study, can this source of error be overcome. It is indeed reasonable to believe that, in a cell which has lost its ability to reproduce and which functions more or less constantly over the years, physiological and anatomical deterioration can readily occur either as a perfectly normal process or as a consequence of some external or internal environmental disturbance. Therefore, not only is the mass of evidence—even though still circumstantial and not entirely conclusive—in favor of the decrease in cell numbers with age, but it seems logical to expect it. I merely point out here that there is still a great need for quantitative studies on the brains of humans and experimental animals, quantitative studies that consider variables and try to control them. Proof for one species cannot necessarily be had from studies on another, since it appears more and more that there is a marked difference in the aging of the nervous system in different species.

### Purkinje Cells

The population of the Purkinje cells is reported to suffer severely with advancing age. In a description of the Purkinje cells of a 92-year-old man, it was stated the cells "appear

considerably shrunken, both nucleus and protoplasm, though not more so than normal daily fatigue" (29). This individual was in a coma and endured 6 days of inanition prior to death. The Purkinje cells were reported to be 25 percent fewer than in the cerebellum of a 47-year-old man. In another study of the cerebellums from 63 humans of both sexes, aged 12-92 years, 43 cerebellums were eliminated from consideration because they "showed the greatest losses," and "cell losses are frequently due to disease" (30).

Similar decreases in Purkinje cells in the dog, the macaque (31), and the rat (32) are reported. Reducing the rat to the equivalent age of man, it was concluded that destruction of the cells or the processes leading to destruction take place 30 times as fast in the rat as in man.

A loss as high as 40 percent in the Purkinje cells of guinea pigs has been reported (33). However, this figure is based on the number of cells in the newborn as 100 percent, and it is important to note that the highest percentage loss—66.7 percent—occurred in one animal of 193 days of age (34). In one area of the cerebellum, 7 animals out of the 10 younger than the oldest (1,800 days) of this series showed more loss of Purkinje cells than did the oldest animal.

In my own series of guinea pigs, whose ages range from 139 to 2,765 days, I have been unable to measure quantitatively any loss of the Purkinje cells. On the contrary, the population seems to be quite stable, and certainly there are no discernible areas in which cells have degenerated and have been removed.

### Pigmentation

Almost every conceivable cytological alteration has been described and associated with age changes (35). These alterations are not restricted to any one part of the brain but seem to occur everywhere. Of these, "the most constant element indicating aging in nerve cells is lipofuscin, the lipochrome pigment. It rarely appears in younger subjects, but does appear beyond a certain age. . . . while we can get lipofuscin in some pathologic conditions, the truth is that we can get a great deal of

this material in elderly persons. . . . this is the most important element shown in the cell and that other elements, such as variation in the neurofibrils, Golgi apparatus and, in some cases, the Nissl bodies will have a secondary place" (35).

The accumulation of pigment occurs at different time intervals in different regions. Certain nuclei are prone to early pigmentation; others fail to show pigment even in advanced age. It has been suggested that constantly activated cells are less prone to pigmentation, while those that undergo periods of rest or inactivity are more likely to become pigmented during the aging process (36-38). In this connection, it is interesting to note that the accumulation of pigment in the nerve cells, as well as some of the other changes with age, are more marked in the human species than in other mammals (39).

### The Glia

The role of the glia in aging is undoubtedly a very important one, although, except for the phenomenon of satellitosis, with the concomitant process of neuronophagia, little is known about these structures. Studies of satellitosis and neuronophagia of the cortical cells of the human (39) and of the horse (40) report definite, increasing occurrence with advancing age. In the rat and mouse, satellitosis was not nearly so marked (41a). This process also occurs in the brains of young animals and humans, where it may be even more frequent than in the very old individuals (41a). No marked qualitative change in glial cell types participating in this process has been reported (41b).

### Ante-Mortem and Post-Mortem Changes

In the human and in the experimental animal, it is at times extremely difficult to separate the changes which can occur in the cells of the brain before and after death. Post mortem artifacts are real stumbling blocks in neurohistological studies and should not be underestimated. I personally do not contend that nerve cells do not show signs of degeneration, die, and are removed by phagocytosis or lysis. However, I do feel that we must proceed as cautiously as

possible in our interpretations of what is normal and what is abnormal in the aging brain.

C. Vogt and O. Vogt (36) point out that the time course and morphologic features of aging are different in each of the hundreds of different cell types, and that "the aging process or 'involution' of a cell is different from any regressive process of 'degeneration' it may undergo, but degenerative processes may, of course, occur in combination with an involution. . . . The aging process always leads to the death of the cell. If it occurs at an average (normal) time, it causes partial death of the brain through normal death of the cell type in question. If a person lives sufficiently long, partial death of the vital cells of the medulla causes his or her death, as a normal phenomenon. This form of death is a rare occurrence, because death through disease usually terminates the individual life at an earlier stage." These authors suggest that the aging process may produce counter-reactions, such as hypertigrosis produced by the increased activity of the nucleolus, or hyperchromatosis and pyknosis of the nucleus which has hitherto been wrongly interpreted as a degeneration. This reaction as a defensive or compensatory change on the part of the individual nerve cells may include division of the nucleoli and the nuclei of the cells as well (33).

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# Physiological Limitations and Age

By JOSEPH A. FALZONE, Jr., M.D., and NATHAN W. SHOCK, Ph.D.

THE PHYSIOLOGY of aging in man rather than age differences in disease incidence has been the chief concern of the Gerontology Branch of the Public Health Service's National Heart Institute. A large body of this latter information is available from other sources (1, 2). In the course of our studies, we have found that aging does not affect all organ systems in the same way.

It is obviously difficult to define rigorously what should be called senescence as opposed to "disease." We can only hope to describe changes that occur with the passage of time in subjects for whom all diagnosable disease, which would affect the organ system under study, has been ruled out. To do this, we apply what we call "uniform subject selection criteria" so that other investigators will know what we mean by the phrase "healthy normal subject" and can judge the results accordingly.

The most basic principle of physiology is that the function of most organ systems is to maintain constancy of the internal environment. This is the principle of homeostasis as advanced by Bernard, Cannon, and others. We therefore require three types of information to characterize physiological age differences effectively.

1. The resting state of the internal environment.

2. The resting organ functions that maintain this state.

3. The reserve or maximal capacities of these organ systems and their ability to defend the internal environment against displacements induced by stress.

## The Internal Environment

Under resting conditions, the internal environment is surprisingly well preserved in the older individual as evidenced by lack of change in body temperature (3) and levels of various substances in the blood. Thus, Shock and Yiengst (4) found that the acid-base equilibrium of the blood is maintained within normal limits in the old man (fig. 1). A slight fall in p<sub>H</sub> does occur with corresponding, but not significant, changes in CO<sub>2</sub> tension and bicarbonate level.

Arterial fasting blood sugar does not change significantly with age (5), but there is some evidence suggesting a slightly higher fasting level in venous blood (6).

Hematological values of the blood are also well maintained in the aged. Shapleigh, Mayes, and Moore (7) determined these values in a series of 100 men and women 60-95 years of age and compared them with previously reported values for healthy young adults. Red cell counts, hemoglobin, and hematocrit values were slightly, and probably significantly, lower in the 60-95-year age group, with a smaller sex difference than in young individuals. Red cell

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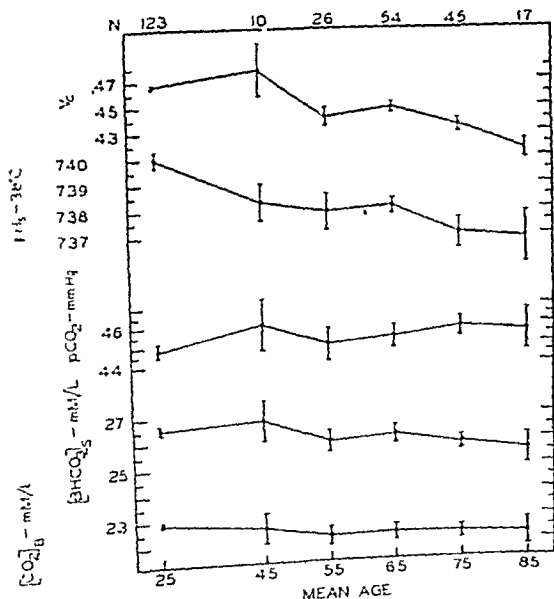
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indexes and reticulocyte counts remained within the normal range, and no definite qualitative erythrocyte changes were seen microscopically. Total and differential leukocyte counts were also unchanged.

### Functional Measures

It must be emphasized again, however, that the data described so far tell us very little of function or reserve capacities of the system for meeting the stresses of daily living. For example, if an individual's daily urea production remains constant while some renal insult suddenly reduces urea clearance, his blood urea will gradually rise until the product of blood level and clearance is once more equal to this tissue production rate. This new steady state level of blood urea will then be evidence of impaired renal function. It is also evident, however, that this same individual, if placed on a low protein diet at the same instant as his renal damage, might show no elevation of blood

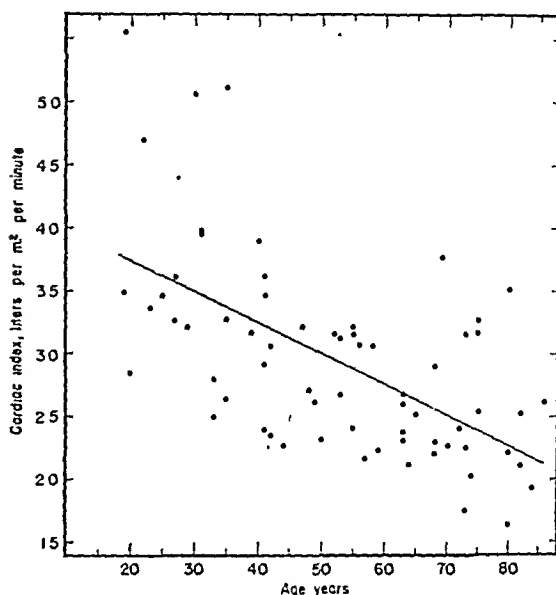
Figure 1. Trends in the acid-base equilibrium of the blood of men with increasing age.



Average curves from top to bottom include percentage of red cells, serum pH at 38° C., carbon dioxide tension expressed in millimeters of mercury, and serum bicarbonate and blood carbon dioxide content, both expressed in millimoles per liter. The vertical lines indicate  $\pm 1$  standard error of the mean.

SOURCE: Reference 4.

Figure 2. The relation between basal cardiac index (liters per square meter per minute) and age (years) in 67 men without circulatory disorder.



SOURCE: Reference 9.

urea. Theoretically, then, physiological functions and reserve capacities can be reduced enormously without change in the internal environment, under resting conditions. In this regard, many of you will recall patients with a progressive downhill course and eventual death despite an impressive list of normal blood chemistries.

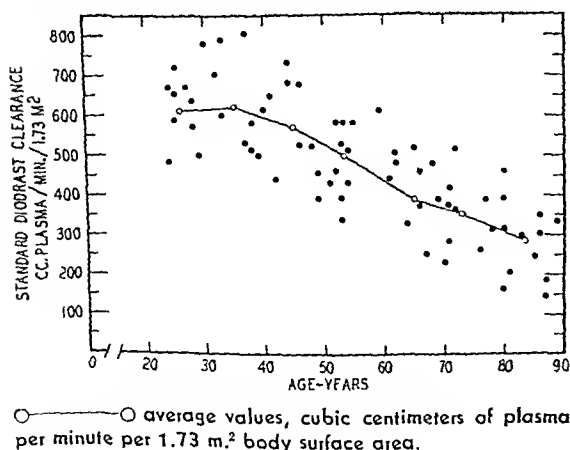
Among functional measures that can be employed, the basal metabolic rate (BMR) is of obvious interest in agewise comparisons. One often hears the suggestion that people "slow down" as they grow older, as evidenced by obvious changes in speech, gait, and cerebration. The ultimate energy source for all of these functions is, of course, oxidative metabolism. Without implying a causal relationship, one might ask if this overall metabolic rate also declines with age, at least under resting conditions. This appears to be the case. Shock and Yiengst (8) demonstrated a significant age decrement in basal  $O_2$  consumption whether expressed as total oxygen uptake for the individual or per unit surface area. Expressed in calories per square meter per hour, the decline is from approximately 36 at age 40-49 to 30 at

age 80-89. This is not dramatically large, but it is highly significant and agrees quite well with most other data. Later, we will have reason to question the adequacy of calculated body surface area as an index of the amount of functioning tissue present in the individual. The fact to be emphasized at this point is that oxygen consumption per individual decreases with age.

A decline in resting cardiac output and cardiac index was found in a series of 67 men by Brandfonbrener, Landowne, and Shock (9), as shown in figure 2. This, of course, tells us nothing of the reserve capacity of the heart for increasing its output under conditions of exercise. We have recently initiated a study designed to give us this information, using exercise carried to exhaustion as the maximum stimulus to cardiac output.

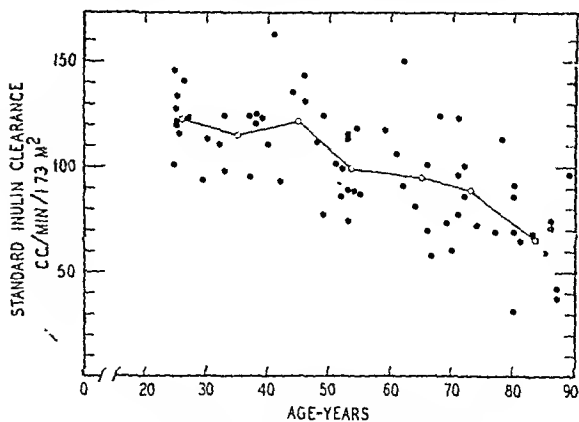
Pulmonary function, in the aspects we have measured, changes markedly with age (10). Thus, total lung capacity (TLC) declines, but in our sample of 140 subjects this is paralleled by a decline in surface area. Total lung capacity corrected for surface area does not change. The compartments of total lung capacity change strikingly, however, with an increase in residual volume (RV) at the expense of vital capacity (VC) and its subdivisions. Thus, there is a shift from mobile to fixed lung spaces. The other large change we have found is in maximum breathing capacity. This falls

**Figure 3. Change in standard diodrast clearance or effective renal plasma flow with age.**



SOURCE: Reference 12.

**Figure 4. Change in standard inulin clearance or glomerular filtration rate with age.**



SOURCE: Reference 12.

from a mean of about 132 liters per minute at age 20-29 to 50 liters per minute at age 80-89. Most of this impairment seen in the older individual is a result of a relative inability to increase respiratory rate under the test conditions.

It may be suggested that our older subjects are suffering from emphysema. Certainly, we cannot distinguish these age changes from emphysema, particularly if an arbitrary value of the ratio of RV to TLC (or VC) is to be the clinical criterion, as it often is. We can only suggest that this common form of emphysema is a relatively constant age change and that the term "senile" emphysema is appropriate.

Of all organ systems maintaining the internal milieu, probably none bears a greater burden than the kidney. The arterial blood reaching the kidneys passes through the glomeruli; of this, about 20 percent is filtered through the glomerular membranes. About 99 percent of this filtrate water is actively reabsorbed by the kidney tubules, together with glucose, amino acids, and electrolytes, while waste products are excreted into the remaining filtrate volume by these same tubules. The external product is urine of variable composition; the internal component, blood plasma of constant composition. Thus, a complete estimate of renal integrity includes measures of the amount of blood or plasma perfusing the kidney, the proportion of plasma filtered, or the filtration

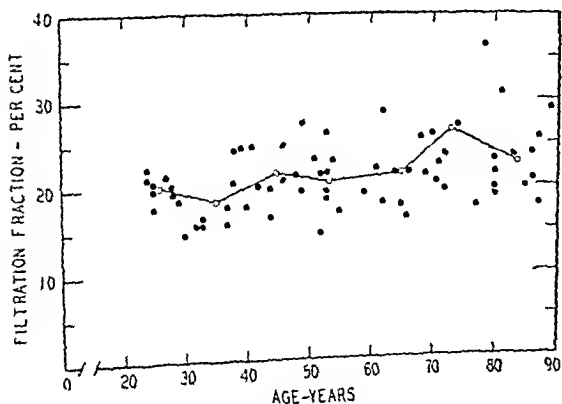
fraction, the amount of glomerular filtrate formed, and the maximum capacity of the tubules to reabsorb or excrete specific substances.

It is found that renal plasma flow, as measured by diodrast clearance, decreases from about 600 cc. per minute in the 20-29-year age group to about 300 cc. per minute in the 80-89-year age group (11, 12). Figure 3 shows a scatter plot of these individual values. It may be seen that some of the 80-year-old subjects have values at least as high as some individuals in the 40-50-year age group. One wonders what values these 80-year-old subjects would have shown in their youth. This variability is seen in many other functions and only stresses the need for longitudinal studies in aging since individuals might show stepwise decrements in function.

Glomerular filtration rate, as measured by inulin clearance, also declines with age as seen in figure 4 (11, 12). This is slightly less than the decline in effective plasma flow so that the filtration fraction increases slightly, but significantly, as shown in figure 5.

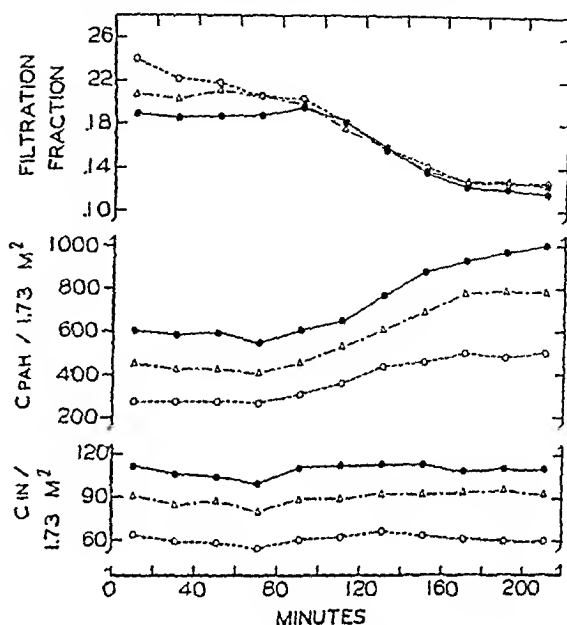
From these data alone, we cannot say whether the reduced plasma flow results from loss of nephrons, reduced flow per nephron, or a combination of these two factors, but the increased filtration fraction would imply a relative increase of efferent to afferent arteriolar constriction. It would also appear that total renal resistance has increased more than total peripheral resistance, since the age decrement in

Figure 5. Change in filtration fraction with age.



SOURCE: Reference 12.

Figure 6. Changes in glomerular filtration rate ( $C_{IN}$ ), effective renal plasma flow ( $C_{PAH}$ ), and filtration fraction during the pyrogen reaction. Fifty million killed typhoid organisms were injected intravenously at zero time.



○ — — — — ○ mean values for 14 subjects aged 70-85 years (O groups).

△ — — — — △ mean values for 20 subjects aged 50-69 years (M group).

● — — — — ● mean values for 20 subjects aged 20-49 years (Y group).

SOURCE: Reference 13.

renal blood flow exceeds that in cardiac output (9) while mean blood pressure does not fall.

Are the apparent changes in the resistance of the kidney to blood flow the result of unalterable anatomic changes in the arterioles or can resistance be lowered by a physiological stimulus? To answer this question, McDonald, Solomon, and Shock (12, 13) tested the effect of a bacterial pyrogen which increases effective plasma flow in young subjects. It was found that effective plasma flow could be increased significantly in all age groups, and that while the absolute baseline and magnitude of increase was smaller in the oldest group the percentage increment was similar to that of the young. The glomerular filtration rate was unchanged by the pyrogen while the filtration fraction necessarily declined significantly to become equal in all age



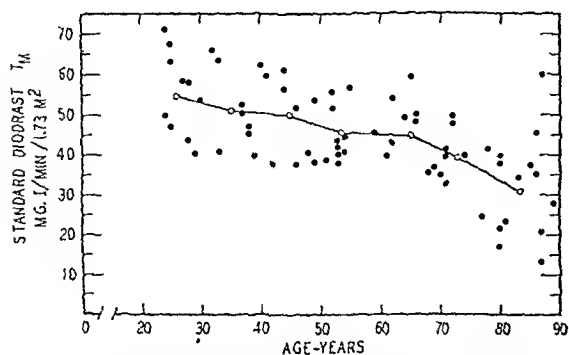
groups (fig. 6). This suggests that a large proportion of the total as well as relative efferent vasoconstriction present in an old kidney is reversible (14).

It was also found that tubular function, as estimated by maximum rates of diodrast excretion and glucose reabsorption, decreased with age, as shown in figures 7 and 8 (11, 12, 15). The magnitude of these decrements is similar to that of glomerular filtration rate (GFR), which suggests that nephrons lose function as a unit. Constancy of the ratio GFR: diodrast  $T_m$  is seen in figure 9. The decline in effective plasma flow, however, exceeds any of these decrements, suggesting that vascular impairment is primary rather than secondary to loss of nephron function (11, 12). This relationship is illustrated in figure 10.

### Possible Effects on Longevity

What do these changes mean with respect to health, vigor, and life expectancy? They are certainly never listed as cause of death. Yet we may ask if they are in some way related to the unfortunate contour of mortality curves—something happens to the individual with time so that probability of death at any moment is not constant but increases with age. This can be illustrated by the results of renal studies. It is known, for example, that urea and inulin are excreted by the kidney in a similar way except that some of the urea diffuses back into

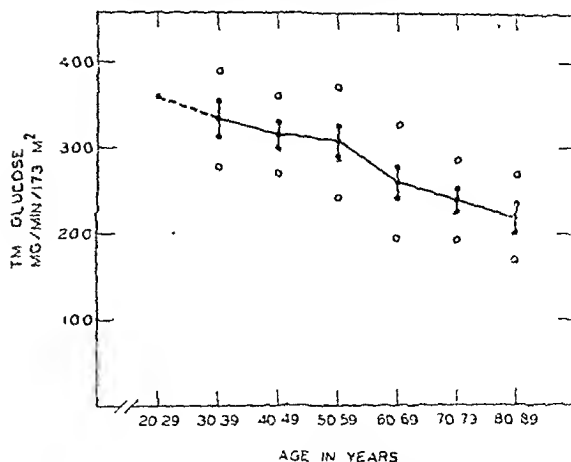
Figure 7. Change in standard diodrast  $T_m$  with age.



○—○ average values, milligrams of diodrast iodine per minute per 1.73 m<sup>2</sup> body surface area.

SOURCE: Reference 12.

Figure 8. Decrease in maximal tubular reabsorptive capacity with age.



The slope is drawn to connect the mean values for each decade. The vertical lines represent  $\pm 1$  standard error of the mean, while the open circles define the limits of  $\pm 1$  standard deviation of the distribution.

SOURCE: Reference 15.

the blood stream. Thus, we would expect urea clearance to show an age effect similar to that of the glomerular filtration rate and also to find some increase in blood urea nitrogen unless an older man's nitrogen catabolism is reduced in a parallel way.

Studies by Lewis and Alving (16) do show an age reduction of urea clearance of about the same magnitude as the fall in glomerular filtration rate as found in our laboratory. An older man's nitrogen catabolism is reduced, but only slightly, and this is not enough to prevent an increase of blood urea nitrogen from 10 mg. percent to 18 mg. percent over a 20-90-year age span. This relationship between blood level clearance rate and production of urea is a simple hyperbolic one, that is, successive constant decrements of urea clearance produce ever larger increments in blood urea.

From this and from the Lewis and Alving data, we can make a simple prediction. Suppose that a 20-year-old man suffers some renal insult such as nephritis or ureteral occlusion which reduces his urea clearance by 25 percent. As a consequence his blood urea nitrogen will increase from approximately 10 to 13.3 mg. percent, or a rise of 3.3 mg. percent. This is still within the limits of normal. If, on the other hand, a 90-year-old man suffers the same fate,

his blood level will rise from 18 to 23.9 mg., an increase of 5.9 mg. percent, which is above the normal range. Further renal insults will serve to magnify this difference. Urea itself is relatively nontoxic, but impairment in reserve will make the accumulation of substances in the body more rapid, and the deleterious effects of toxic substances will be more marked in the old man.

It is more difficult to make predictions with respect to pulmonary function. Although the maximal breathing capacity is normally much higher than the ventilatory level attained with violent exercise, it is quite likely that there is a correlation between the two levels, and we have some preliminary findings which support this. However, by making a variety of assumptions with regard to dead space and tidal volume, it can be calculated that ventilation volume per se does not limit the oxygen uptake or exercise performance of an older man until values below 20 liters per minute are reached. As these calculations were designed to demonstrate the effect of ventilation alone, they assume perfect mixing of air in the lungs. Since mixing is not perfect, the age changes in lung compartments we have observed would tend to impair lung transport and thus produce arterial oxygen unsaturation and undue demands upon cardiac output at ventilation volumes higher than calculated. Thus, we see that an impairment in one physiological system places an added bur-

Figure 9. Change in rate of glomerular filtration per unit of diodrast  $T_m$ .

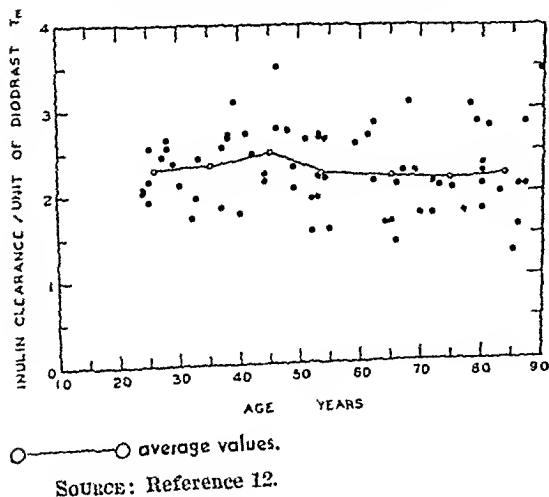
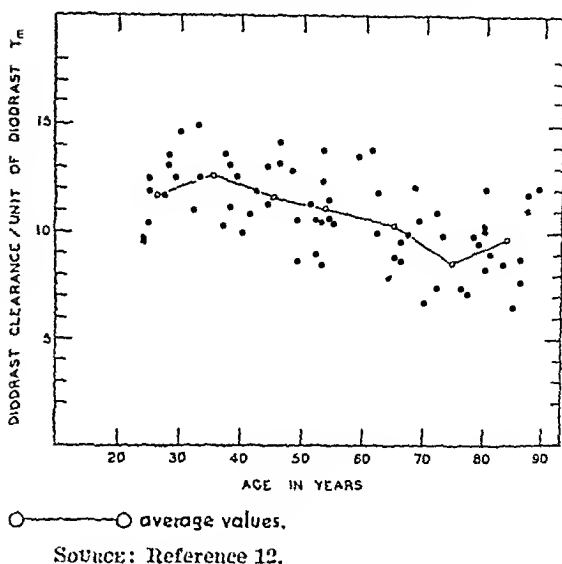


Figure 10. Change in effective renal plasma flow per unit of diodrast  $T_m$ .



den upon another system whose functional capacity may also be decreased with age. What we have observed so far is that the maximum work rate of an old man is reduced; we are now trying to discover the relative importance of pulmonary, cardiac, or muscular limitations.

It is also not too difficult to imagine an adverse effect of pulmonary limitations upon life expectancy. For example, an older individual with reduced ventilatory capacity and mixing efficiency is in a far more precarious position with superimposed lobar pneumonia than is a young man.

### Mechanisms of Aging

We have described some physiological age changes in man, with some possible consequences with respect to vigor and longevity. We must now ask how these changes come about. It is apparent that functional loss in an organ system implies either loss of active protoplasm or qualitative difference in the protoplasm. To estimate the relative importance of these two factors, we obviously need some good index of protoplasmic mass. There is quantitative histochemical evidence that, for a given tissue, protoplasmic composition is relatively constant with respect to water and electrolytes and does not change with age (17). Thus, intracellular

water, which can be estimated in intact animals, should serve as a better protoplasmic index than body weight or calculated surface area, which are obviously affected by such nonprotoplasmic materials as fat and edema fluid.

By using the antipyrine space as a measure of total body water and the thiocyanate space as an estimate of extracellular space, the intracellular water may be calculated as the difference between these two. Shock, Yiengst, and Watkin (18) found that total body water and intracellular water decrease significantly with age while the extracellular space does not change. Since these estimates were made for the same subjects used in studying the basal metabolic rate, they could be applied as BMR reference standards for each individual. It was found that basal  $O_2$  consumption per unit of total body water or intracellular water does not change with age (fig. 11). This would suggest that, in terms of net metabolic activity, the protoplasm of an old man is unchanged; he simply has less protoplasm (19). Morphological studies of a variety of tissues in man support this viewpoint. Thus, a variable weight loss of many organs occurs with age, accompanied by widespread cell shrinkage, cell loss, and relative or absolute fibrosis (20).

Qualitative cellular changes are equally interesting. Nuclear abnormalities (21, 22) and vacuolated mitochondria (21-24) are observed as well as deposition of highly insoluble "age" pigments in heart, brain, and adrenal (21, 25, 26). Lansing (27) has summarized evidence for a loss of cell permeability accompanying increased calcium binding of the cell cortex. The implications of these changes, with respect to cell function, are intriguing, but can we say they are primary changes? We must ask another fundamental question posed by the overall histological appearance of old tissues: Does the intercellular material passively replace cells which shrink or die as they grow old or do the cells die only because they are literally strangled by connective tissue which ages and loses permeability? Or are both altered independently?

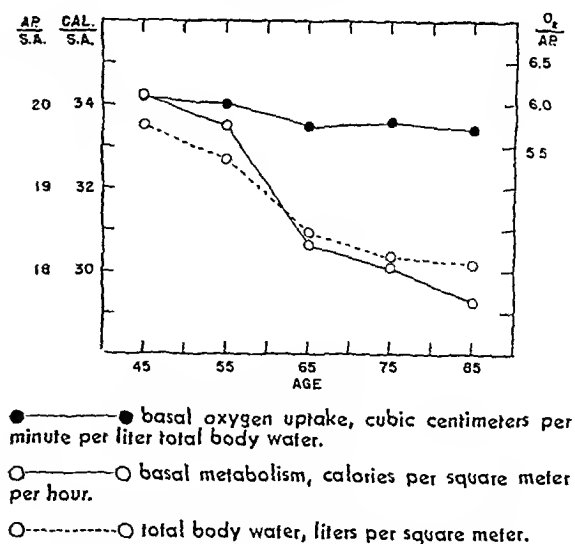
In some organs, such as the liver and adrenal, cell shrinkage and loss overshadows fibrosis and might, therefore, be considered a primary factor (20). However, the absence of dramatic morphological change in a tissue does not rule

out the possibility that subtle alterations, such as reduction in blood flow or permeability, play an important role in aging. In other organs, such as the kidney, parenchymal changes may be secondary results of vascular lesions. It is possible that all of the renal age changes are secondary to progressive arteriolar change (20). The fact that the age decrement in renal plasma flow exceeds loss of tubular function would support this view although we can hardly cite it as proof. We cannot be sure that the nephrons would not eventually age in the absence of vascular changes. In short, we have no proof as to the primacy of either intracellular or extracellular changes as the basic cause of aging.

Lansing has summarized some evidence for the hypothesis that aging is a consequence of growth cessation (27). His own work shows that longevity of rotifers is inversely proportional to maternal age, that this effect is cumulative through successive generations, and that this progressive shortening of life span first appears when maternal age exceeds the growth phase of this organism. Lines of rotifer, with constant "old" maternal age, were termed "geriaclones" (27, 28).

Experience with tissue culture tends to reinforce this concept, but in a less definite manner. Thus, many cell types show unlimited

Figure 11. Age changes in basal heat production



SOURCE: Reference 19.

growth potential in vitro (29). Even adult human neurones have not entirely lost the capacity for mitosis, as shown by Murray and Stout (30). It is of interest that only neurones relatively free of age pigments were observed in mitosis. However, the experience with neurones and other cultures reveals a general antagonism between growth rate and tissue organization (29-31). Cell lines with high growth rates may survive indefinitely but show poor differentiation, while slowly growing cultures show more organization but are difficult to maintain. In fact, nonmitotic cells in culture generally live only a fraction of their survival time in vivo so we cannot yet say that they "age" as a consequence of growth lack; they simply do not survive or have not been observed for a sufficient length of time (29). Perhaps culture methods can be improved to the point where we can actually decide whether such cells inevitably age in the absence of their normal connective tissue environment. Obviously, this could be most easily tested with cultures from short-lived animals. Neurones from rat and man are morphologically alike, yet their normal life spans differ by a factor of 30. How would their survival times compare in vitro? So far, all we can say is that in vitro the price of immortality is chaos.

### Research Needs

The question of primary causes of aging can be answered only by further research on both the human animal and lower life forms. We have studied many aspects of aging in man in the Gerontology Branch, but this field is far from exhausted. As a single example, we have seen that hematological values are only slightly altered with age, but we need information on the rate of replacement of plasma proteins, red cells, and leukocytes. We would also like to know the factors producing the great individual variability we have observed. Why do some 80-year-old men have the physiological reserve of men 30 or 40 years their junior? In this variability lies hope, if we can discern its cause. Longitudinal studies are pertinent to this question. The Gerontology Branch has existed long enough so that we are beginning to gather some of these data on both patients and investigators.

There is, however, information that can only be obtained by animal experimentation, as for example, age changes in tissue composition and enzymatic activity. Such studies on the rat are now in progress in the Gerontology Branch. Some other fundamental researches are best applied to invertebrates, many of which have the twin virtues of uniform genetic composition and very short life spans. The utility of such organisms is illustrated by such excellent studies as that of MacArthur and Baillie (32) on the temperature dependence of life span in *Daphnia magna* or by Lansing's work on rotifers (27, 28). These two studies jointly raise a curious question. The geriatclone rotifers show, in addition to shortened life span, earlier sexual maturity and accelerated growth rate but smaller final size. These are precisely the four effects seen in *Daphnia* raised at high temperatures. Why this should be so we have no idea, but it is obviously an important clue. It is problems like these which urgently require solution. The questions that face us are difficult, but there is no real reason to believe that they are unanswerable.

### Summary

Examination of experimental studies on physiological changes with age indicate that, under resting conditions, the aged human is usually able to maintain uniformity of the internal environment. However, when increased demands are placed on a number of organ systems, impairment of function can often be detected. Thus, the primary characteristic of the older individual is a reduction in reserve capacities which makes him more vulnerable to stresses of even daily living than the young. These changes take place gradually over the entire adult life span and may, in part, be attributed to a loss of functioning tissue. The causes of this loss have not been identified. One of the outstanding characteristics of age change is the striking difference in vulnerability among individuals. At the present stage of research, we cannot identify the factors that determine these individual differences. It is not yet possible to determine the relative importance of loss of functioning tissue and alterations in cellular metabolism in producing the age changes in

physiological function which have been observed. Extensive research, including biochemical, physiological, and histological studies on species other than man will be required to answer these important questions.

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# Age Changes and Employability

By L. F. KOYL, M.D., D.T.M.H.

THE Department of Veterans Affairs of the Dominion of Canada is comparable to the Veterans Administration in the United States. Among the employees in its Toronto district, it has about 250 persons who are reaching retirement age each year during the fiscal years 1954-64. The facilities of the DVA's 1,800-bed teaching hospital, Sunnybrook, offered an opportunity to study the problems of these aging employees.

In 1954, the assessment unit of Sunnybrook Hospital was publishing data about the problems of the older deteriorating veteran. We requested and were allotted the problem of studying the whole employee in his total environment. Other studies, including an atherosclerosis project and an arthritis study, parallel our work. If the group studying the aging employee detects a problem of interest to any of these groups, their facilities are available to us. Other DVA hospitals in other university centers have special interests under study.

Our terms of reference are:

1. To study a large group of aging employed persons over a period of years to discover the incidence and the rates and direction of change in the various pathological processes accompanying age, including social, economic, medical, and psychological processes.

2. To establish a valid clinical method of assessing the aging worker as an individual and of comparing him with his fellows.

3. Therefrom, to establish criteria for continued employment beyond fixed retirement ages.

4. Therefrom, to develop a practical method for examination of the aging employee to determine his suitability for continued employment.

5. To study the rate, direction, varieties, and measurement of intellectual deterioration and to develop practical, accurate, and brief testing procedures.

6. To explore the possibility of correlating clinical evidence of deterioration with laboratory evidence in a practical manner.

7. As a corollary to the above, to study (a) the positive prevention of total or partial deterioration in older workers and (b) means of keeping older workers working and free from disability.

8. As a further corollary to the above, to study methods of preparing individuals for successful retirement.

We thus began a 5-7-year study, using the multidisciplinary approach, with medicine, psychology, sociology, and economics all involved. We favor placing no limitations on the inventiveness of our members except the tolerance of volunteers to an examination already requiring 6 hours.

It is difficult or impossible to do quantitative analyses on any except the simplest aspects of human behavior, such as chemistry. We therefore had to devise methods of converting qualitative data into semiquantitative data. We

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## Restorative Services for Older People

*The following text was issued in a limited edition as a leaflet for the Federal-State Conference on Aging, June 5-7, 1956, Washington, D. C., prepared by the Hygiene of the Aging Section (now the Health of the Aged Section) of the Chronic Disease Program, Division of Special Health Services, Public Health Service. It is published here to emphasize that many forms of rehabilitation may be constructive, whether or not the patient recovers full physical and economic independence.*

There is convincing evidence that a substantial backlog of aged patients for whom restorative services would be appropriate has accumulated in the institutions and communities of this country. All professional workers in the health field should be alive to the opportunity for restoring many of these older people to self-care. The private physician, the health officer, the director of an institution—all should inform themselves concerning the highly significant possibilities in this area.

Restorative services for older people aim at permitting resumption of necessary daily activities by patients themselves through physical and psychological restoration, and at maintenance of maximum self-care by followup procedures. The group for which restorative services are most appropriate is made up of those aged patients who would otherwise be committed to a virtually helpless condition for the rest of their lives, but no disabled patient should be denied services which will maximize his physical and mental capabilities. In certain cases patients not only can be physically restored for daily living so that need for care is reduced, but can, through further rehabilitation, become employable again.

Three questions are significant in this field:

1. To what extent is restoration to self-care possible?
2. What kind of personnel does the job require, and how many?
3. What is the cost of the service?

### Results of Restorative Services

Reports on the extent of possible restoration to self-care are not numerous, nor always comparable, but certain salient facts have already been recorded. In England the United Oxford Hospital reported that three-quarters of the surviving patients who received these services were rehabilitated by the end of 3 months. At the District of Columbia General Hospital roughly two-thirds of the patients receiving restorative services returned to the community capable of self-care (including both inpatients and outpatients). At the Allegheny County Home (Pennsylvania) the proportion of patients achieving self-care after restorative services varied from 40 to 70 percent: arthritics, 60 percent; amputees, 70 percent; hip fractures, 60 percent; stroke cases, 40 percent.

### Personnel

Ideally, the restorative service team includes: physician director (preferably a physiatrist), psychiatrist, psychologist, physical therapist, occupational therapist, speech and hearing therapist, recreational worker, social worker, nutritionist, and nurse. Few institutions can afford ideal staffing, but much can be accomplished by (a) inservice training of the existing staff, (b) the addition of a few rehabilitation specialists (either full time or on a consulting basis), and (c) the maximum use of community resources.

The Allegheny County Home program is a successful example of what can be accomplished through this approach.

### Cost

Accurate cost analysis of restorative service programs cannot be made at this time because of variations in cost accounting and in staff and equipment. For example, the District of Columbia General Hospital charged against these services \$58,501 for treatment of 883 patients over a 14-month period, an average charge of about \$66 per patient treated. On the other hand, the New York University-Bellevue Medical Center estimate for the annual cost of rehabilitation personnel operating a 100-bed restoration service is \$104,000 (unpublished data). Each institution must estimate its own costs. It should be noted that the services normally show successful results within 3 months, if success is to be achieved.

In summary, restorative services for older people have been proven to be effective; it has been established that personnel are available or can readily be trained for this work; the cost of the program can be kept within reasonable limits.

On the basis of these facts, it is hoped that early action will be taken in communities throughout the country to initiate these activities.

Finally, it must be constantly emphasized that this problem and this opportunity confront the entire medical profession; restorative services are by no means limited to institutional situations. Wherever old people can benefit by this type of service—in the home as well as in the hospital or the nursing home—the service should be supplied. This is a medical, a health responsibility. It is a challenge to everyone responsible for the health of older people.



Our estimates of probable change are plotted in the lower half of the chart. It will be noted that age plus 5 years is the abscissa so that the overall pattern is comparable in the two halves of the chart. The artificial cutoff now occurs at age 70. The sharp bends from G5 to G6 and from G6 to G7 are obviously due to the small samples at G6 and G7. Otherwise there is a slight angulation toward the right in both mean and median lines. Such angulation to the right suggests decreasing fitness with increasing age. The standard deviation of G1 is 3.5, which makes this suggestion probable as the mean curve moves to the right at least 7.1 points relative to G1 between G1 and G5.

The number and degree of the pathological processes going on in the middle-aged employee

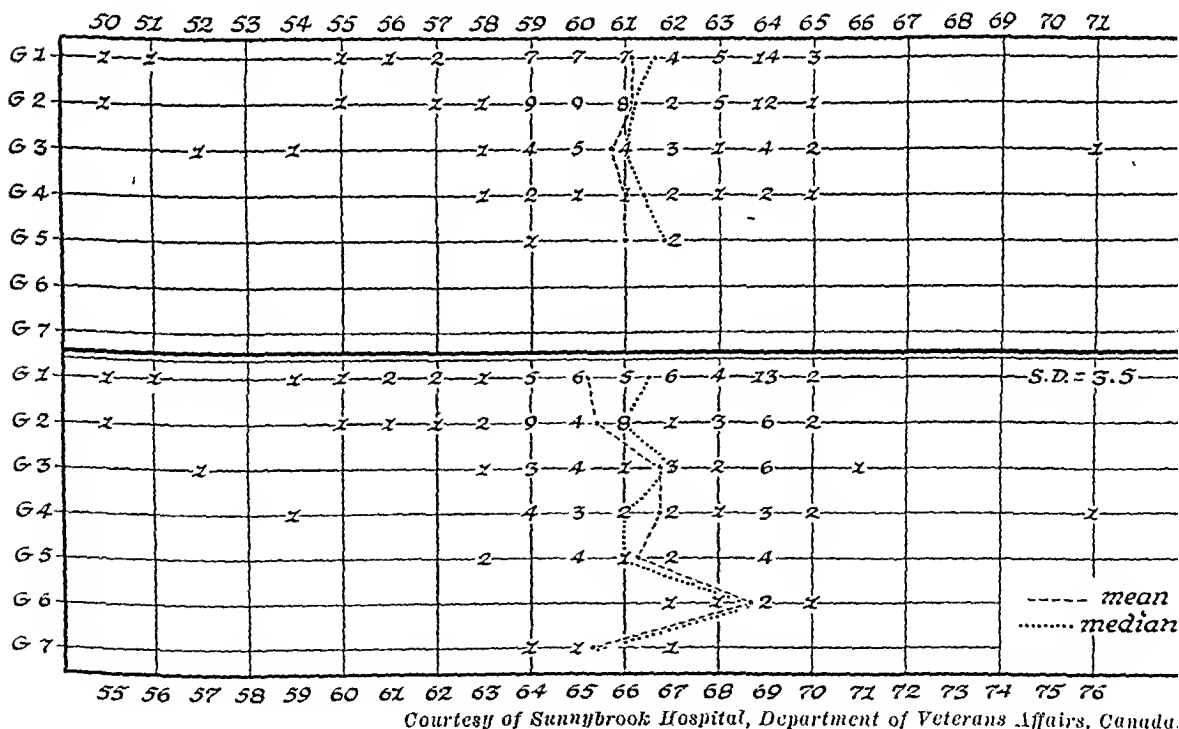
will be no surprise to the practicing physician although the universality of these processes may be surprising. They become evident gradually in the forties so that the rate of deterioration in health is a straight-line curve to the sixties. Health begins to deteriorate more rapidly as the seventh decade approaches.

## Psychological Report

### *Some Aspects of Intelligence*

The calculated intelligence of the volunteer and a clinical prediction of the rate of change shown in figure 2. The prediction in the lower half of the chart is based on clinical evidence from the various types of disease already present and otherwise is based on the pre-

Figure 1. General physique of 150 employees of retirement age. Upper half, results of examination; lower half, estimated probable changes.



G1 Fit for heavy manual work, including digging, lifting, climbing, regularly as main occupation.

G2 Fit for manual work, including incidental or occasional heavy work as in G1—can work on shifts.

G3 Fit for all employment except heavy labor, liable to deteriorate if meals and rest inadequate.

G4 Fit for sedentary employment with regular hours for meals.

G5 Fit for restricted employment or part-time employment. "The handicapped worker" in home or out.

G6 Self-care only.

G7 Bedfast.

those functional profiles of our own devising, including the Gullhemp scale. It is important to note the two words "functional" and "profile." A profile can be graphed, machine coded, and so on. If it is a profile of functional ability and is explicit enough, it can be used for job descriptions, employment examinations, and so on.

A most important factor in our work is accuracy of prognosis. We are deliberately making 5-year prognoses when we feel that we have the knowledge to do so and we shall check the accuracy of the prognoses by seeing all volunteers again at 2½- and 5-year intervals. We have already made many repeat examinations for reemployment after age 65 and have been pleased to see that we are very close in our estimates of the type and direction of change in pathological processes. How accurate we are in our estimates of the rate of these changes will not be known for a few months.

### Medical Report

There is no real difference in the type of disease found in the working population in this study (median age 61.05 years) and the type found in deteriorating veterans (median age 70.0 years) applying for domiciliary care (1,2). The difference found is one of degree.

A discussion of preliminary findings follows. The work of our medical and psychology workers is emphasized since reports on the social and economic aspects of the study have been published (3).

In only 6 of the 150 volunteers could the diagnosis of "no appreciable disease" be made. However, all were working; therefore, none were truly disabled.

There were 65 fixed disabilities, mostly from wounds, injuries, and operations. Osteoarthritis caused recognizable symptoms and signs in 38 persons. Varying degrees of atherosclerosis were observed in 33 persons, 2 of whom have since died after massive coronary occlusions. Other disease processes were observed in 119 persons. Varicose veins were a problem in 13. Varying degrees of deafness were noted in 33, while 78 had decreasing visual efficiency. There were 8 possible premalignant skin lesions.

### Laboratory Findings

In all 150 volunteers, the hemoglobin reading was over 80 percent; the average was 90 percent (15.6 gm. percent=100 percent).

In 24 of 60 cases the sedimentation rate was over 20. Two females were not counted as abnormal because their rates were marginal (22 and 24); in the remaining 22, none of the usual causes of an elevated rate were present.

Results of 24-hour steroid tests on 60 cases were as follows:

Test	Number cases	Range (mg. per- cent)	Average (mg. percent)	
			60-65 years	49-59 years
17 ketosteroids.....	30	5-15	6.8	6.8
Crude corticoids.....	{ 29 1	{ 1-3 3.8 }	1.7	1.8

The frequency of abnormal sedimentation rates is interesting. Possibly emotional stress due to the prolonged examinations caused this abnormality. Two-thirds of all abnormalities were recorded at 4:00 p. m., after the volunteers had been under emotional tension for 6 hours.

The lack of correlation of steroid values with age is contrary to the findings of previously published studies on hospitalized groups. The studies on sedimentation rates and steroid values will be continued and coordinated. It will be necessary to obtain electrophoretic serum protein studies on a group with abnormal sedimentation rates plus adrenal steroids and, possibly, C-reactive protein studies.

### Physical Findings

General physique is the most important determinant of general employability as distinct from fitness to engage in a specific occupation. The accompanying frequency distribution chart (fig. 1) illustrates this aspect of fitness for continued employment. An artificial cutoff (except for one case) in the number of persons over 65 years of age is included in this early stage of the survey. This cutoff will disappear as we re-examine our increasingly large sample at intervals of 2½ years.

In the top half of the chart, which shows the results of examinations, there is no slope to the mean or median lines. There is no evidence, therefore, of correlation between age and general physique in the limited sample aged 50-64 years.

Table 1. Summary of Wechsler-Bellevue performance

Subtest	Number of cases	Range <sup>1</sup>	Mean <sup>1</sup>	Standard deviation of mean	Rank	Median <sup>1</sup>	Correlation coefficient (R) with I.Q.
Information.....	149	4-18	11.17	2.72	2	10.72	0.784
Comprehension.....	148	4-16	10.61	2.59	3	10.31	.679
Digit span.....	147	2-17	9.12	3.36	7	9.06	.624
Arithmetic.....	148	1-18	9.73	4.38	6	8.96	.787
Similarities.....	149	1-17	9.02	3.37	9	8.75	.802
Vocabulary.....	148	6-17	11.86	2.61	1	11.84	.812
Picture arrangement.....	149	1-14	7.77	2.86	10	6.92	.686
Picture completion.....	149	3-14	10.03	2.47	4	9.45	.685
Blocks design.....	149	1-16	9.08	3.33	8	8.53	.836
Object assembly.....	149	0-16	9.87	3.30	5	10.32	.668
Digit symbol.....	146	0-15	7.25	2.37	11	6.46	.678
Intelligence quotient:							
Full.....	148	79-143	113.79	13.11	-----	114.80	-----
Verbal.....	148	76-139	111.35	12.45	-----	111.50	-----
Performance.....	148	89-144	118.46	11.74	-----	118.71	-----
Deterioration quotient.....	146	-68% - +57%	+1.98	19.95	-----	+1.83	-.436
Efficiency quotient.....	147	55-134	98.37	16.07	-----	100.32	-----

<sup>1</sup> Weighted score.

toration in intelligence and organic brain damage. Only five cases had clinically perceptible brain damage and, therefore, organic deterioration. In 122 cases, beginnings of functional deterioration were determined by psychometric or clinical methods of observation, or both.

The average I.Q.'s of the 148 subjects on whom complete Wechsler-Bellevue tests were done are shown in table 1.

Manual ability has not deteriorated to the expected extent in these subjects. The age credits for this need revision.

There was an inverse relationship between the deterioration quotient and intelligence. Exactly one-half of the subjects showed the expected deterioration; 32 percent showed more deterioration than expected and 18 percent, less than expected.

The deterioration quotient as presently calculated is only of qualitative value. The "hold-don't hold" formula needs revision. Some of the "hold" items for example, require sensory acuity of a degree which is not usual for this age group.

Rigidity is an outstanding characteristic of these subjects, especially when thinking at an abstract level is required. Our volunteers had difficulty in tasks requiring concentration or a focus of attention. In some, considerable tension was generated by such requirements.

We would prefer to use efficiency quotients as a standard instead of intelligence quotients, but we are not sufficiently sure of the true meaning of the efficiency quotient.

### *Some Aspects of Personality*

The distribution pattern of the personality types of our volunteers as recorded at the weekly meeting is shown in figure 3. The predicted rate of change shown in the bottom half of the chart is based on clinical knowledge of the usual rate of change in known syndromes as seen by experienced observers. Ages have been offset by 5 years to allow direct comparison of the slope of the means.

The difference between P1 and P2 in the top half of figure 3 is undoubtedly due to the smallness of the sample. Otherwise there is no visible slope to the mean or median line. If our predictions are valid, there is a slope downward and to the right in the half of the chart which represents our 5-year predictions. To test the importance of this trend, the standard deviations of P3 and P4 were calculated. The CR difference calculated from these is 1.75, which is at the 5 percent level of confidence.

It is safe to say, therefore, that there is no significant deterioration in personality in this group in the age range 49-59 years. If our predictions are valid, there will probably be deterioration in personality in the sample at a

vious experience of the authors. Intrappolation of results was also possible because the procedures had been tested on younger and fitter, as well as on older, more deteriorated groups before beginning this survey.

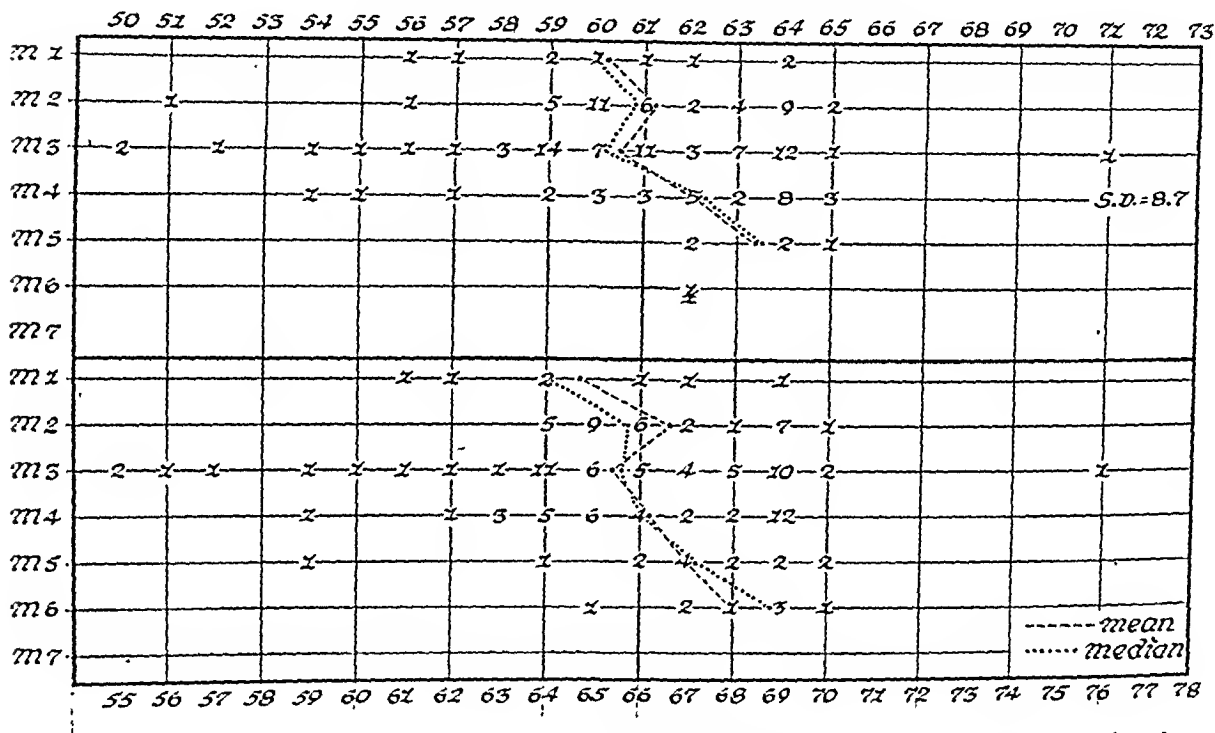
In both upper and lower halves of the chart, both median and mean lines curve sharply to the bottom right. The standard deviation of M4 in the top half of the sample is noted to be only 8.7. This is probably significant.

In terms of M4, the change between M3 and M5 is 11.4.

In this sample, intelligence probably begins to deteriorate at between 50 and 65 years of age. If our predictions are valid, deterioration will continue at approximately the same rate in the following 5 years. (The slope of the "examined" and the "predicted" mean lines are the same.)

There is little or no correlation between de-

Figure 2. Mentality of 150 employees of retirement age. Upper half, results of examination; lower half, estimated probable changes.



Courtesy of Sunnybrook Hospital, Department of Veterans Affairs, Canada.

M1 Intelligence of a superior order capable of understanding and undertaking long-range planning, organization of details, integration of different aspects of a plan; flexibility and individual initiative. I.Q. 140-129.

M2 Intelligence sufficient to plan and carry out work accurately without supervision. Knowledge of job's relationship in broader setting and ability to assume and execute responsibility under supervision. Capable of working accurately under pressure. I.Q. 128-110.

M3 Intelligence sufficient to work accurately under normal supervision and normal conditions. Capable of learning new skills as required. Skilled labor. Normal intelligence. I.Q. 109-91.

M4 Intelligence sufficient for simple routine tasks under supervision, can learn related tasks. Semi-skilled and labor. Dull normal intelligence. I.Q. 90-80.

M5 Requires extra supervision due to slowness and failure to understand. Unskilled labor. High-grade defective. I.Q. 79-70.

M6 Requires almost constant supervision and direction at each stage of work. Learning ability poorly demonstrated. Constantly supervised labor. Moron. I.Q. 69-60.

M7 Unable to understand nature of job or remember steps in an operation. Unemployable in any capacity. Imbecile and idiot. I.Q. 59-0.

Table 2. Reaction patterns of 150<sup>1</sup> "normal" personalities

Type of dominant characteristic	Total with dominant characteristic	Type of additional characteristics <sup>2</sup>									
		Schizoid, introverted, seclusive	Paranoid	Withdrawn	Rigid, stereotyped	Dependent, passive	Active, impulsive, aggressive	Psychopathic	Hysterical	Depressed	Anxious
Schizoid, introverted, seclusive.....	23	XXXX	4	7	8	5					10
Paranoid.....	4		XXXX		2	1					3
Withdrawn.....	14			XXXX	3						6
Rigid, stereotyped.....	24			4	XXXX						16
Dependent, passive.....	2					XXXX					2
Active, impulsive, aggressive.....							XXXX				
Psychopathic.....	15		1		4	3	7	XXXX			6
Hysterical.....									XXXX		
Depressed.....	14				2	1				XXXX	11
Anxious.....	17				2	3			2		XXXX

<sup>1</sup> Less 32 too normal to categorize readily, although some showed early signs of slipping, and less 5 with organic deterioration.

<sup>2</sup> Figures indicate number who have these characteristics in addition to dominant characteristic.

the psychologist, who uses tests such as the Rorschach which do not use direct questions. Fairly strong motives are discovered best by such techniques, especially if they are contrary to the principles of action of the integrated patient. Even negative information, such as gaps in work histories, are valuable clues to personality. The composite picture obtained can be translated into the jargon of any profession.

Our psychologist used two unstandardized tests of her own devising to assist in sorting out the personality patterns of this age group. They were an adjective list descriptive of optimistic and pessimistic mood states and a sentence completion test consisting of 60 phrases all beginning with "I" or "My." These have been useful with volunteers but, as practical instruments in an industrial situation, they are subject to evasion, although they would be useful in specific instances.

Our volunteers were very modest about their intellectual endowment; 74 percent specifically denied being clever. They were very free in admitting emotional upset; 53 percent claimed to be chronically tense and anxious. About one-third feel insecure, that they are slipping in their work, are growing more seclusive, and have a lowered frustration tolerance. The lack of structure of the sentence-completion test

threw them on their own resources and was too great a challenge for some, resulting in confusion, superficiality of response, or inability to respond.

The Rorschach test is an extremely useful tool for testing individuals in the older age groups. Unlike younger groups, the older person does not accept or enjoy the challenge of this test, and the lack of a defined structure produced confusion, anxiety, and self-doubt. The majority of the volunteers were unable to handle the intangible or the abstract. They were sure there had to be a "right way" to solve the test. In almost all the records, there was a hint of this superficiality and rigidity. In some, it was predominant. When the patterns were emotionally stimulating, there was actual withdrawal with overt tension.

## Conclusions

1. We have developed methods of assessing older employees which, within 2-5 years, by deletion and rearrangement, can be made practical and economical for industry. By that time, the substitution of a disability retirement plan for a fixed-age retirement plan should be medically feasible and sound efficiencywise. The economics of such a plan need further

statistically significant rate in the group aged 65-70 years (1 man aged 70).

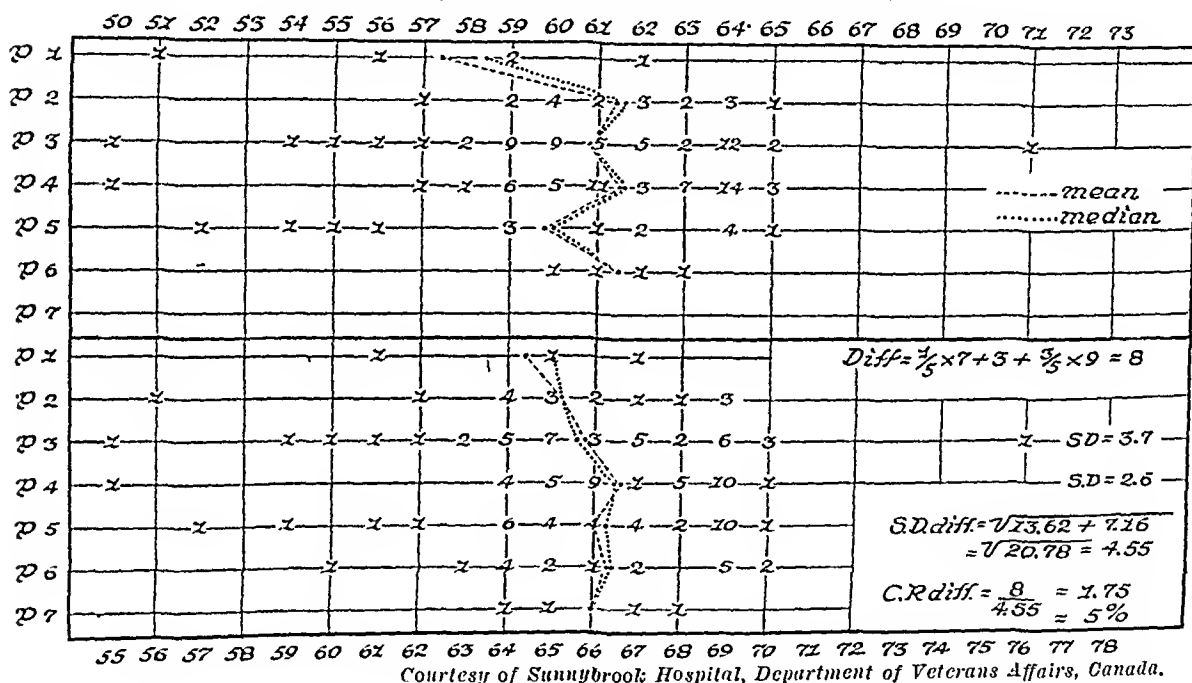
The personalities of our sample are a cross section of their age group. It must be emphasized that all these employees are earning their living and are therefore "normal." Any other criteria of normalcy are rather unrealistic in this far from perfect world.

To facilitate future study, the reaction pattern of each person was determined. The group was then subdivided according to predominant reaction (table 2). Such a subdivision is inevitably rough since the higher the personality

and intelligence rating, the more difficult it is to classify an individual. In 32 cases, the attempt was abandoned.

The dominant personality type of each volunteer was determined clinically. At the weekly conference of examiners, the personality of each person in the study is, of course, the subject of group discussion. Each examiner brings to the conference information of value. Some volunteers talk well to the doctor; others become expansive and confidential with a financial officer; others, whose basic desires are battened down under fairly secure hatches, disclose more to

Figure 3. Personality of 150 employees of retirement age. Upper half, results of examination; lower half, estimated probable changes.



Courtesy of Sunnybrook Hospital, Department of Veterans Affairs, Canada.

- P1 Personality sufficiently stable to work with others in supervisory or administrative capacity; capable of earning cooperation of co-workers and respect of his abilities. Flexibility in interpersonal relationships and understanding of problems of the job, loyalty to organization.
- P2 Personality sufficiently stable to work well with others and willing to assume partial administrative or supervisory responsibilities if required. Capable of taking direction without rancor.
- P3 Personality sufficiently stable to take constructive criticism or advice. Cooperation with others without need to be on the defensive. Self-reliant.

- P4 Personality shows signs of doubting own ability, hesitancy, and "tentative" attitude. Requires encouragement and support. Capable of cooperation with others.
- P5 Personality shows signs of cracking under pressure of work criticism or staff changes and moves. Manifest in withdrawal or agitation or both.
- P6 Personality shows signs of poor or defensive interpersonal relationships with overt criticism of others and difficulty in work relationships.
- P7 Personality chronically shows signs of tension, anxiety, or withdrawal sufficient to disrupt work efficiency and interpersonal relationships. Severe neurotic or prepsychotic.



## Workshops and Seminars

Highlights of workshop sessions at the Ann Arbor conference are reported by representatives of the Public Health Service. In addition the chairman of the Committee on Aging reports the recommendations of two seminars on professional training.

### The Geriatric Clinic

Personnel from a geriatric clinic in New York City and from another in Florida presented their respective programs as a basis for discussion. One presentation emphasized the role of the geriatric clinic in the hospital, and the other, the role of the clinic in the community.

Such demonstration programs serve as teaching centers in geriatrics. They furnish information on the problems of the aged for their communities and provide other communities with useful information about managing the special needs of the aged.

Experience in these clinics has taught that, though the initial steps of performing a thorough examination and working out the plan of individual medical care are time consuming, they greatly reduce the time spent in maintaining patient care.

Special consideration to the needs of the aged may be given in a comprehensive care clinic or in a geriatric clinic. In either place, someone whose competence and attitude is oriented toward care of the aged should direct and coordinate the program.

Many agencies and professional workers believe services to the aged should be complete. Cooperation of the many agencies concerned, with a major guiding influence, would permit

such complete services to be realized with economy.

—MARTHA BALL NAYLOR, R.N., B.S., M.P.H., *chief nursing consultant, Chronic Disease Program, Division of Special Health Services.*

### Housing and Long-Term Care

Discussions on housing by a group of physicians, nurses, hospital administrators, housing experts, and representatives of nursing homes were vigorous and enlightening.

They agreed on the following points: Those who are ill require medical care and nursing home facilities. Low-cost housing is a pressing necessity for the well or almost well, with varying degrees of homemaking service. Coordination between agencies that provide medical, welfare, and recreational services to the aged should be improved. Housing for the aged should not lead to regimentation or decrease the individual's independence. The aged should not be segregated. Integration with young people in housing projects should be encouraged.

They agreed that community surveys were necessary to indicate community needs and resources. The survey data, objectives of the facilities, and requirements for major equipment and employees in each area will provide the architect with the information necessary to appropriate design and construction. "Form will follow function."

They agreed that housing or long-term care facilities for the aged should be located in pleasant surroundings and should be accessible to visitors and employees. The availability of utilities and public transportation is of prime importance. The physical plant should be of

study, as do the precise limits of its applicability.

2. Functional deterioration in mentality and personality antedate and overshadow organic deterioration. Rigidity and withdrawal particularly should be susceptible to preventive methods.

3. The increasing rigidity of the aging employee makes large retraining schemes in industry uneconomical, except where an absolute shortage of a skilled trade exists, and suggests that the routine retention of rigid senior executives is unwise.

#### DOCUMENTATION NOTE

Copies of the Gullhemp scales have been deposited as document No. 5063 with the American Documentation Institute, Photoduplication Service, Library of

Congress, Washington 25, D. C. A photoprint copy may be obtained by remitting \$2.50; a 35-mm microfilm copy by remitting \$1.75. Advance payment is required. Make checks or money orders payable to Chief, Photoduplication Service, Library of Congress. Copies of the scales may also be obtained from the author.

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## Still Going Places

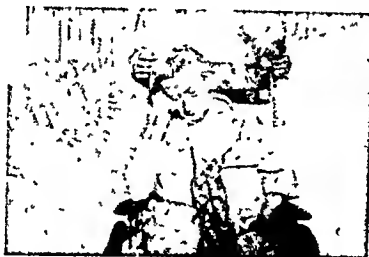
### *Active Management of Disability in the Aged*

16 mm., black and white, sound, 1,450 ft., 40 minutes. 1955.

Audience: All physicians, especially specialists in physical medicine and rehabilitation.

Available: Film Library, Pfizer Laboratories, 630 Flushing Avenue, Brooklyn 6, N. Y.

A medical documentary film, written and directed by George C. Stoney in collaboration with Frederic D. Zema, M.D., and Leo Dohrin, M.D., of the Home for the Aged and Infirm Hebrews of New York, this film demonstrates practical ways in which chronically ill or acutely dis-



abled patients of advanced years can be helped to live useful, self-sufficient lives.

A wide range of examples is



shown, each underlining the basic principle of active management: "by promoting movement one preserves the ability to move."





paid up at age 65 and others which are non-cancelable and on which the company can raise the premium only if it does so for all policyholders of this class.

There was rather common agreement that arrangements are needed for funding the increased cost of health care for the aged over the individual's working life or of spreading the extra cost of health services for the retired among all active employees. Insurance company representatives felt that there was no problem about covering employees over age 65 who are still working or retired workers who are receiving pensions, and they believed means could be developed for including retired employees in a company's group insurance program. They felt that the problem of health insurance for low-income aged persons was but a special aspect of that for all persons who have incomes too low to enable them to purchase insurance.

Recommendations proposed at the concluding session of the workshop ranged all the way from having private carriers press forward with their vigorous efforts to provide health insurance coverage to the aged, to provision of hospitalization benefits as part of the Federal Old-Age and Survivors Insurance program.

—LOUIS S. REED, Ph.D., *health economist, Occupational Health Program, Division of Special Health Services.*

## Implications for Nursing

Physicians laid the groundwork through discussions on the physiological and psychological age changes and on helping the older person be independent.

Three nurses spoke on the implications for nursing in helping the older person to independence. One described the rehabilitation program of the Visiting Nurse Association of Allegheny County in Pittsburgh and exhibited self-help devices which the association has available for loan. One emphasized the need to examine hospital practices, attitudes, and mores, stating her belief that in many instances these meet the needs of the hospital and its personnel rather than those of the patient. One briefly pointed out general implications for

nursing, relating them to the discussions on physical and mental health at the Federal-State Conference on Aging in Washington, D. C., June 5-7, 1956 (see page 1209).

—ESTHER KAUFMAN, R.N., B.S., *public health nursing consultant, Chronic Disease Program, Division of Special Health Services.*

## New Careers in Gerontology

Preparing medical students and professional workers for dealing with the diseases and disabilities of old age was the subject of a seminar on geriatric medicine conducted by Dr. E. V. Cowdry, director of the Werle Cancer Clinic, Washington University Medical School, and a second seminar conducted by Clark Tibbitts, Department of Health, Education, and Welfare, at the Ann Arbor Conference on Aging.

Other professional occupations associated with gerontology include professors of social work and public health, educators, State officials, administrators of old-age homes, case-workers, vocational rehabilitation workers, and counselors.

The seminar on geriatric medicine included senior faculty representatives of 10 medical schools as well as the Veterans Administration and the Public Health Service. A spirited discussion quickly brought general agreement that departments of geriatrics would be unwelcome additions to medical schools. It was also agreed that the schools must focus increasing attention on the problems of the aged. Students need to develop a more wholesome attitude toward this group of complex patients. Research needs to be intensified.

Although it is recognized that the faculty of each medical school will make its own arrangements, a coordinator for aging is needed to act as a focal point for activities related to aging.

The coordinator could be in any medical school department although most often he would be in the department of internal medicine. He would head an interdepartmental committee concerned with incorporating appropriate material on aging into the curriculum content of each department. He would spark research and would serve as liaison officer with

sufficient size to be operated economically. The possibility of future expansion should be kept in mind. A homelike atmosphere should prevail. Safety features should be included. Dark and congested areas should be avoided.

Staffing and programing of facilities for oldsters will depend on the size, number, and extent of medical and allied services in the area. Additional allowances must be made for administrative and maintenance service.

It is evident that new money is required to pay for personal health services. Redistribution of existing expenditures will not be sufficient. Old-age and survivors insurance is one source of funds available to the aged. Voluntary insurance is popular with many, but there is need to expand present voluntary insurance to include major medical contracts, home nursing, convalescent home care, appliances, drugs, and so forth.

—DANIEL J. DALEY, M.D., *assistant chief, Division of Hospital and Medical Facilities.*

## Criteria for Retirement

A review of different types of retirement plans led to the quest for suitable criteria for retirement.

Chronologic age as a criterion for retirement is considered unsound economically and socially, having no relation to the nature of the worker's job or to his ability to perform his work. A retirement age should be determined by the health and performance of a worker. Retirement should be related to capacity and ability to perform gainful work. The goal in each individual instance should be to maximize employability. There is no evidence to substantiate the allegation that it is difficult to administer selective retirement.

Much research is needed on physiological age and other debated criteria for retirement. The practice of preparing employees for retirement should be adopted more widely. In described examples of this practice, emphasis is placed on annual physical examinations, annual talks on retirement plans, and frequent review of attendance history, production, attitude toward job, and present and previous health records.

When review discloses deficiencies, part-time employment is suggested.

Aging workers need, among other things, training and retraining facilities, community placement services of adequate size and composition, and well-supported educational opportunities.

—WILLIAM M. GAFAFER, D.Sc., *technical adviser, Occupational Health Program, Division of Special Health Services.*

## Financing Health Services

The problem of meeting the cost of medical care for the aged was considered so important a facet of their health care that one of the three general sessions of the conference was devoted to this topic.

A spokesman for the private insurance companies said that in due course private effort would meet the problem. The private companies have already developed new types of policies for the aged. He noted that employers were working toward providing health insurance benefits for retired workers.

A representative of the United Automobile Workers held that the greater health needs of the aged, combined with their low financial resources, made it impossible for private insurance companies to provide adequate coverage. The solution lay, he believed, in expanding old-age and survivors insurance to provide hospitalization benefits, and presumably later, medical benefits to retired workers.

The workshop sessions on insurance methods for meeting the medical costs of older people were largely concerned with the present activities and accomplishments of Blue Cross-Blue Shield, insurance companies, and cooperative health plans in providing health insurance coverage to the aged.

A representative of the Michigan Blue Cross plan described in detail his plan's provisions for carrying retired employees including arrangements whereby they are carried as members of the employee group, receiving the same benefits at the same costs as active employees. Representatives of the insurance companies told of individual health insurance policies they have developed, including policies which are

paid up at age 65 and others which are non-cancelable and on which the company can raise the premium only if it does so for all policyholders of this class.

There was rather common agreement that arrangements are needed for funding the increased cost of health care for the aged over the individual's working life or of spreading the extra cost of health services for the retired among all active employees. Insurance company representatives felt that there was no problem about covering employees over age 65 who are still working or retired workers who are receiving pensions, and they believed means could be developed for including retired employees in a company's group insurance program. They felt that the problem of health insurance for low-income aged persons was but a special aspect of that for all persons who have incomes too low to enable them to purchase insurance.

Recommendations proposed at the concluding session of the workshop ranged all the way from having private carriers press forward with their vigorous efforts to provide health insurance coverage to the aged, to provision of hospitalization benefits as part of the Federal Old-Age and Survivors Insurance program.

—LOUIS S. REED, Ph.D., *health economist, Occupational Health Program, Division of Special Health Services.*

## Implications for Nursing

Physicians laid the groundwork through discussions on the physiological and psychological age changes and on helping the older person be independent.

Three nurses spoke on the implications for nursing in helping the older person to independence. One described the rehabilitation program of the Visiting Nurse Association of Allegheny County in Pittsburgh and exhibited self-help devices which the association has available for loan. One emphasized the need to examine hospital practices, attitudes, and mores, stating her belief that in many instances these meet the needs of the hospital and its personnel rather than those of the patient. One briefly pointed out general implications for

nursing, relating them to the discussions on physical and mental health at the Federal-State Conference on Aging in Washington, D. C., June 5-7, 1956 (see page 1209).

—ESTHER KAUFMAN, R.N., B.S., *public health nursing consultant, Chronic Disease Program, Division of Special Health Services.*

## New Careers in Gerontology

Preparing medical students and professional workers for dealing with the diseases and disabilities of old age was the subject of a seminar on geriatric medicine conducted by Dr. E. V. Cowdry, director of the Werle Cancer Clinic, Washington University Medical School, and a second seminar conducted by Clark Tibbitts, Department of Health, Education, and Welfare, at the Ann Arbor Conference on Aging.

Other professional occupations associated with gerontology include professors of social work and public health, educators, State officials, administrators of old-age homes, case-workers, vocational rehabilitation workers, and counselors.

The seminar on geriatric medicine included senior faculty representatives of 10 medical schools as well as the Veterans Administration and the Public Health Service. A spirited discussion quickly brought general agreement that departments of geriatrics would be unwelcome additions to medical schools. It was also agreed that the schools must focus increasing attention on the problems of the aged. Students need to develop a more wholesome attitude toward this group of complex patients. Research needs to be intensified.

Although it is recognized that the faculty of each medical school will make its own arrangements, a coordinator for aging is needed to act as a focal point for activities related to aging.

The coordinator could be in any medical school department although most often he would be in the department of internal medicine. He would head an interdepartmental committee concerned with incorporating appropriate material on aging into the curriculum content of each department. He would spark research and would serve as liaison officer with

the general university. It is vital that he have full financial support and control of an adequate budget.

Graduate departments should be organized to train investigators and teachers in geriatric medicine, the seminar indicated. It was agreed that large numbers of geriatricians are not required for service programs since medical care of older people is the legitimate province of the internist and the general practitioner.

Although the second seminar was exploring a relatively uncharted field when it considered professional training for gerontology, it was able to reach several major conclusions.

For example, it was agreed that middle age and old age are identifiable periods of life, having characteristics that should be studied in all of the life science and social science courses given in secondary schools and in colleges and universities.

Equally general was the agreement that gerontology is a science in its own right and that all professional persons planning to work with older persons should have specialized training throughout their preparation in didactic instruction and fieldwork.

This seminar identified three principal occupational categories calling for specializing in work with older persons: the professional occupations such as social work or adult education, related occupations having some involvement with older persons, and generalists in aging.

The generalist was defined as an individual who has a broad knowledge of the characteristics, needs, and circumstances of aging and older people; understanding of aging as a social, cultural phenomenon; knowledge of community organization and resources; and skill in working with individuals and groups. His training should draw upon the biological, psychological, and social sciences at the graduate level.

Generalists are employed as community and State coordinators in aging, administrators of old-age homes, specialists in voluntary and governmental agencies, and executives of university programs. As awareness of the expanding field grows, the number of places open to generalists is expected to increase rapidly.

As to the administrative location of gerontol-

ogy training in a university, the seminar leaned toward establishment of a new department or institute that would offer core courses in gerontology combined with elective courses in related departments.

—CLARK TIBBITTS, *chairman, Committee on Aging, Department of Health, Education, and Welfare.*

## Health Assessment of the Aged

Guidelines for health evaluation of aged patients were matched against experience in a wide variety of settings. These included clinical and group practice, special studies, retirement communities, and industrial health services as well as a public assistance program for periodic evaluation of nursing home residents, a geriatric clinic, and a rehabilitation program in a county home.

There was agreement that assessment of the aged person's health must be a total evaluation of his physical, psychological, and social state as well as his potential response to restorative services. Each discipline described not only its function in evaluation of current status but also what it could contribute to restorative services. Evaluation was seen as a continuing process rather than as a single-shot verdict.

There also was agreement that we have few controls against which to evaluate the physical, emotional, and social status of aged patients.

Throughout the discussion, the lack of standards or adequate tests for the aged was a recurrent theme. Hypertension in the aged was described as a relatively benign disease, usually overtreated. Internists commented that many symptoms in aged patients do not have the same significance they would have for the young. They described marked discrepancies between findings at autopsy and the functioning ability of a person immediately before death: Many functioned well despite severe physical handicaps; others functioned poorly although their physical condition appeared to be relatively sound.

Psychologists commented that tests which have been developed for adolescents and young adults do not apply to the aged. For example, a psychiatrist described an engineering pro-

fessor approaching retirement who made a poor score on blocks and numbers tests but who was brilliant at explaining abstruse differential equations to graduate students. He had passed so far beyond elementary skills that he no longer had use for them. Another psychiatrist commented that dreams of the aged have quite different interpretations from those of the young.

Social scientists described changes in responsibilities, roles in the family and community, and expectations of the aged. Social workers described differences to be considered in offering service to the aged, for example, the possible need for shorter, more frequent, and perhaps more continuous contacts by whoever is offering service.

A point of complete agreement was the importance of considering patients' functional ability and potential, with emphasis not on what had been lost but on what remains or can be restored. Also of prime importance are a hopeful attitude on the part of staff working with the aged and the factor of hope in the aged person himself.

—ELEANOR MORRIS, M.S.W., *medical social consultant, Heart Disease Control Program.*

## Nutrition and Health

Dietary habits of aged persons and their food needs were reviewed by a physician and by research and public health nutritionists. How to plan menus that meet nutritional needs was discussed and demonstrated by the use of illustrative material.

The points brought out were not new or startling. Rather, the discussion leaders cited studies and experiences which emphasized the following accepted nutrition facts.

The importance of individual variations with respect to nutrient needs, total calories, and so forth must be kept in mind always. Thus, what is a maintenance diet for Mrs. Jones may be excessive in calories for Mrs. Smith or deficient in nutrients for Miss Brown.

The aged person needs protein of high quality daily, preferably some at each meal. The National Research Council's recommended protein allowance of 65 grams daily for men aged

65 was seen by some speakers as the low limit of desirable protein intake for both men and women.

The utilization of protein is related to the total calorie intake. Studies have shown that aged women on self-selected diets were in nitrogen equilibrium only when they were consuming 1,600 to 1,800 calories a day.

Since physical activity plays an important part in the body's ability to utilize foodstuffs, aged persons should be encouraged to maintain a level of activity compatible with their physical ability.

Total calorie needs decrease for each person as his body ages. Nutrient needs (for vitamins, minerals, protein) do not seem to decline and may be increased. To maintain good nutrition without increasing body weight, the aged individual must select food with care. Regular meals probably help in attaining this objective.

Although eating a variety of foodstuffs and choosing foods from the basic seven may be the easiest way of assuring an adequate nutritive intake, diets that are fairly monotonous may still be nutritionally balanced, depending on the foods eaten, the amounts consumed, the preparation methods. A survey in one State institution bears out this point.

—DOROTHY M. YOULAND, M.S., *nutrition consultant, Chronic Disease Program, Division of Special Health Services.*

## Mental Illness Among the Aging

Two meetings were devoted to mental illness in the aged. The first discussed present-day State, county, or city mental institutions, which are recognized as lacking in facilities for the proper treatment of both acute and subacute psychosis among the aged.

A professor of psychiatry advocated the establishment of psychiatric services for the aged at nursing homes and other facilities where psychiatric care could be given on a part-time or full-time basis. He also advocated the building of public institutions for the care of the aged that would provide them with appropriate psychiatric services.

The second meeting was devoted to mental illness among the aged in the family setting. It was agreed that when acute and subacute mental illness was properly treated, prognosis for the aged was as good as for young patients. It was agreed further that many mentally ill individuals could be handled best either at home full time, if given proper outpatient psychiatric treatment, or at home part time and the

rest of the time in a mental institution or psychiatric hospital. Much emphasis was given to the need for part-time institutional care for many of the aged who have mental illness that is not completely incapacitating.

—SEWARD E. MILLER, M.D., former chief, Division of Special Health Services and presently director, Institute of Industrial Health, University of Michigan.

## Reading List on Aging

Two general bibliographies on aging have been issued since 1951: Selected References on Aging; An Annotated Bibliography, 1953, and Publications on Aging; Selected Reports of Federal Agencies, 1956. The former was compiled for the Committee on Aging by the Library of the Department of Health, Education, and Welfare, and the latter by the Federal Council on Aging. These bibliographies may be obtained from the Superintendent of Documents, U. S. Government Printing Office, for 30 cents and 15 cents, respectively.

Both bibliographies are annotated and classified and include not only references to books and pamphlets but also to articles appearing in periodicals.

"Selected References on Aging" includes some 500 items compiled from current literature in the field. They are arranged within three broad interest categories: social aspects; economic and employment aspects; and the aging process, with respect to health and medical care. Other sections include reports on conferences and State commissions, conference and group discussion methods, periodicals, community helps, and personal adjustment. There is an author index.

"Publications on Aging" includes some 78 reports by or for various Government agencies. Among these items are bibliographies and exhibits, motion pictures, recordings, and scripts.

Although there is some duplication in the two bibliographies, together

they afford a fairly comprehensive coverage of the literature.

The following references, not contained in these bibliographies, also may be helpful.

Brewster, A. W., and McCamman, D.: Health costs of the aged. U. S. Social Security Administration Division of Research and Statistics, Report No. 20. Washington, D. C., U. S. Government Printing Office, 1956, 126 pp. Price 65 cents.  
California Legislative Assembly Interim Committee on Social Welfare: The nonpsychotic seniles and related problems. Report . . . House Resolution No. 195, 1953. Sacramento, 1953, vol. 19, No. 1, 109 pp.

Council of State Governments: The States and their older citizens. A bill of objectives and a program for action. Chicago, 1955. (Full report to the Governors' Conference priced at \$3.)

Donahue, Wilma, and Tibbitts, Clark: European approaches to aging. Pub. Health Rep. 70: 581-584, June 1955.

Federal Council on Aging: Federal responsibilities in the field of aging. A statement by President Eisenhower and a summary of recent and proposed actions of the Federal Government affecting older persons. Washington, D. C., U. S. Government Printing Office, 1956 (?).

Illinois Public Aid Commission: Rehabilitation education service of the Illinois Public Aid Commission. Springfield, 1956 (?). Mimeographed.

Illinois Public Aid Commission Advisory Committee on Aging: Progress report on services for aging. Exhibit J. Springfield, 1956, 6 pp. Mimeographed.

Kaiser, Philip M.: Statement, at the Federal-State Conference on Aging. Washington, D. C., 1956, 6 pp. Mimeographed.

Mumford, Lewis: For older people—Not segregation but integration. Architect. Rec. 119: 191-194, May 1956.

Our aging population. Progress in health services (Health Information Leaflet) 5: 1-4, June 1956.

Rosenthal, P.: Second childhood, the second period of creativity. Geriatrics 10: 382-390, August 1955.

Ross, Mabel: Is there a grandparent in the house? Adult Leadership 3: 7-28, February 1955.

Sex and age differences in disability. Statist. Bull., Metrop. Life Insur. Co. 37: 1-4, May 1956.

U. S. Bureau of Old-Age and Survivors Insurance: How earnings affect social security benefit payments. OASI-23. Washington, D. C., U. S. Government Printing Office, March 1956, 15 pp. Price 5 cents (\$3 per 100 copies).

U. S. Department of Health, Education, and Welfare Committee on Aging: The States and their programs in aging. A descriptive survey of the organization and activities of the official State groups on aging. Washington, D. C., 1956. Multilithed.

Symposium: Problems of the mind in later life. Geriatrics 11: 137-179, April 1956.



## Toward Improved Health for the Aging

AT THE Federal-State Conference on Aging in Washington, D. C., June 5-7, 1956, more than 250 State and Federal officials met to study the field of aging and to work toward practical programs. Following panel discussions six groups drafted recommendations with respect to Federal and State responsibilities, organization, and techniques for improving the health and welfare of the aged. The panel discussions on health and rehabilitation and the recommendations on physical and mental health are summarized here. Major recommendations of each working group were reported in the June 25, 1956, bulletin of the Social Legislation Information Service, Washington 6, D. C. Proceedings of the conference will be available from Louis H. Ravin, secretary, Federal Council on Aging, Department of Health, Education, and Welfare, Washington 25, D. C.

### DISCUSSIONS

#### **Federal-State-Local Responsibilities**

The Federal Government has a vital interest in the aging problem, Dr. Lowell T. Coggeshall, special assistant for health and medical affairs to the Secretary of Health, Education, and Welfare, said in pointing to the need for public and private agencies to work together to find realistic solutions. Excellent work is being done by the voluntary agencies, and the Government should support, not supplant, such work, he said.

Coggeshall urged development of active programs of restorative services in every community to increase the functioning of the sick and disabled older person to his highest attainable level while reducing the costs of his care. Day centers and day hospitals and physical or

mental therapy will tend to lessen the demand for hospital beds and bring treatment to more patients.

Research is as much a State as a Federal responsibility, Dr. Coggeshall declared. It should be carried out by the operating agencies of the State as well as by the State's medical schools. Stimulation of programs of home care, training of more practical nurses, and proper use of existing facilities will all help to reduce cost of care.

Living arrangements which permit activity, participation, and productivity will prevent a considerable degree of mental deterioration, he noted. Because almost all older people suffer periods of depression, particular care must be taken to see that these people are not committed to State hospitals during these periods. The use of intensive therapy at State hospitals has brought about a significant increase in the discharge rate. Such treatment has a higher cost per day, but its total cost is much less since the patient remains in the hospital a relatively shorter time.

Coggeshall listed four responsibilities of the official health agency: public education, stimulation or provision of services, training of adequate numbers of health personnel, and research.

The Administration's philosophy, he said, is that maximum freedom must be guaranteed to our senior citizens. The emphasis is on encouraging individual initiative within our free society, and thus enriching life for every individual.

The aging problem is primarily a community responsibility, according to Dr. Henry Mulholland, chairman, Committee on Aging, American Medical Association. He emphasized the need for careful community planning



and for coordination of various agencies and facilities. He noted that, while such institutions as nursing homes, homes for the aged, and rehabilitation centers are all necessary, "they should not make us forget that the home itself is often where the older person is happiest, when it is possible for him to remain there."

### Neglected Health Problems

Dr. Lester Breslow, chief, bureau of chronic disease, California Department of Health, said that all too frequently aged patients in institutions are there not because of their disease but because of neglect of the disease. With modern methods, persons suffering a stroke need not remain bedridden the rest of their lives.

Dr. Breslow mentioned the need for good nutrition in later years and said that such everyday necessities as eyeglasses, hearing aids, and dental care should not be overlooked. Early detection through multiphasic screening can often help prevent or delay diabetes, glaucoma, and cancer. He emphasized that "we should make sure that the money we spend for our older population is wisely spent, not for more drugs and more beds—mere custodial care—but for the newer diagnostic, rehabilitative, and other services which will truly advance the health of the aging."

Degenerative disease is now an obsolete term, Breslow said. Even arteriosclerosis and cancer can be helped, and we now believe these may be due to specific environmental factors rather than to inborn, constitutional causes.

In one study of nutrition in persons from 50 to 80 years of age, it was found that many were not getting vitamin C and other nutrients necessary to a well-balanced diet. A health and health services survey in Santa Cruz County highlighted need for eyeglasses, hearing aids, and dental care among the aged. One California county health officer organized a health checkup for every recipient as he was accepted for assistance, with a view to correcting or alleviating conditions needing attention. The public welfare budgets in most counties do not provide enough money to maintain adequate health standards for recipients.

### Rehabilitation Services

"Restorative medicine," a term describing measures taken to improve the functions of people with disabilities resulting from illness that comes with aging, was discussed by Dr. Michael Dacso, director of geriatric rehabilitation, Goldwater Memorial Hospital. We must rehabilitate people to self-care without regard to their vocational goals, he said. We can expect higher dividends by investing more at the beginning through skilled workers and excellent services. How to get the young medical man acquainted with and interested in the problems of the aged and the chronically ill is a question we must answer.

Few rehabilitation services are available to the aged who are disabled, according to Dacso. The tendency is to do the most for the reemployable. Probably 70 to 80 percent of all the disabled could be cared for at home with proper medical direction and auxiliary help.

We should practice "anticipatory medicine" (Stieglitz' term); that is, we should anticipate complications which may arise with a particular illness and take steps to prevent such complications. Rehabilitation services are expensive, but economy measures in rehabilitation frequently turn out to be more expensive in the end. People who could have been directed toward partial or complete self-help at the beginning of their trouble are robbed of that opportunity as they lose more of their health or their initiative and self-reliance.

Common, garden-type depression or melancholia is the type of mental illness most frequently encountered among older persons. Metabolic disorders and senile dementia are other common troubles. But even many afflicted with senile dementia could be returned to their homes. A fact we must face is that many families do not want their aged members back after they have had institutional care. Probably between 60 and 70 percent of old people in mental hospitals could be returned to their homes, although not necessarily as self-supporting citizens.

Today the medical pendulum is swinging back from hospital care to home care, Dr. Jack Ewalt, Massachusetts commissioner of mental health, observed. He stressed the need for careful research on all phases of aging and de-



plored the use of such thoughtless generalizations as "all old people should retire" or "all old people should keep on working."

### Cost of Care

E. A. Van Steenwyk, director of the Philadelphia Blue Cross, gave examples of the mounting costs of hospital care and explained the expense of carrying older persons on the insurance rolls. He added, however, that companies must continue coverage on policyholders as they grow older. Blue Cross continues to cover policyholders who are retired or aged or both, he pointed out, but no insurance firm can do this unless it has had subscribers long enough to build up a funding system big enough to cover the expense of the aged.

More use of public health nursing services could be made and would pay off. It is far more economical to keep the moderately ill or the chronically ill patient at home than to put him in a \$25- to \$30-a-day hospital bed, Van Steenwyk noted. He urged closer coordination of the various agencies concerned with the aging problem and "wise spending" of all money appropriated toward this end.

## RECOMMENDATIONS

The working group on physical and mental health emphasized the need to intensify community education to increase understanding of the problems of the aged and to make known what facilities and services are available. The group agreed that each individual must do his best to maintain his own and his family's health. With the objective of helping people to help themselves, they made the following recommendations:

*Maintenance and promotion of health.* Health and health-related agencies and groups should take constructive action to maintain and promote the health of all persons through programs for early detection of disease, prevention of disease and its consequences, suitable care during illness, and restoration of physical and mental health. All facilities for the care of the aged, including foster care homes, nursing homes, specialized housing, hospitals, and rela-

bilitation centers, should be of high quality. They should provide for careful medical appraisal and social evaluation of each individual.

*Treatment of the whole person.* State and community agencies should fully accept the concept of treatment of the whole person, as opposed to a focus on a particular disease entity. Analysis of the health and welfare characteristics of the community should serve as the basis for coordinated services to lessen the effects of disease and to reduce stay in hospitals and institutions.

*Homelike conditions.* Institutions and hospitals should not be regarded as the normal habitat of human beings. It is deemed of great benefit to the individual, the family, and the community to keep individuals in their own homes. If this is not possible, care should be provided in a situation approaching home conditions as closely as possible.

*Participation in community life.* States and communities are urged to encourage aging persons to participate in all phases of personal and community life. For example, financial incentives should be used to encourage nursing homes to keep patients mobile and to make full use of community services.

*Community services.* Community services for the aged should be provided to fill the needs of the individual fully but economically. Services should include homemaking aids, public health nursing, nursing homes, hospitals, case-finding activities, and rehabilitation. Transition of the patient between the simple, more economical services and the complex, more expensive ones must be easy.

*Commitments to mental hospitals.* Because of lack of suitable facilities at the local level for care of older persons, many are being needlessly committed to State mental hospitals. Medical care at the local level that includes screening, diagnosis, and early treatment can prevent many unnecessary commitments and certain other psychiatric casualties.

*Nursing homes.* To improve the quality and quantity of medical and nursing care in nursing homes, general hospitals and nursing homes are urged to work together in developing effective working relationships. Wherever possible, nursing homes should be administratively affiliated with general hospitals.

*Food and drug protection.* Official agencies should extend research, evaluation, and regulations concerning special foods, drugs, cosmetics, and various devices which are especially appealing to aging persons and which may be harmful to them.

*Research and demonstrations.* Federal, State, and private agencies should provide grant-in-aid funds for demonstrations of community health services for the aged and for both basic and applied research in gerontology.

*Teaching of basic concepts.* Funds should be provided to develop programs in universities for teaching students in health and related fields the basic concepts essential to the care and understanding of the aged. The need for focusing attention on the problems of the health of the aged can best be met by the appointment of a coordinator.

*Alleviation of personnel shortages.* To alleviate acute shortages of trained personnel in health, hospital, and related facilities, it is recommended that refresher training programs be expanded or initiated to develop community personnel resources; that action be taken to expand and improve acceptable professional training schools and facilities; that the possibilities of short courses for training personnel to aid professional staff be studied; and that recruitment programs be stepped up to permit maximum use of all existing and future training facilities and services.

*Coordinating and advisory groups.* Each State and each community should develop an effective, broadly representative organization to study and make known the problems and needs of the aging population and to suggest, support, and coordinate suitable and meaningful activities within existing agencies to meet these needs. All official health, welfare, rehabilitation, edu-

cation, and recreation agencies should be represented in this organization. In addition, there should be a citizens advisory group to provide liaison between this organization and the general population. This group should include representatives from interested professional societies and voluntary agencies.

*Retirement.* Retirement based on attainment of a certain chronological age results in some employees remaining on the job beyond the time when they are productive while others are retired who still have years of productive life ahead. Government and industry should be encouraged to expand and extend their health evaluation programs with the objective of determining more accurately the proper time for retiring individual employees.

*Health insurance.* Health insurance and other programs for financing medical care should permit flexibility in the use of treatment facilities and should facilitate transfer of patients among hospitals, nursing homes, and their own homes. Extension of voluntary health insurance coverage to the aged and arrangements for continuing health insurance after retirement, with benefits adapted to the increased health needs of older persons, should be encouraged. The utilization of health insurance plans should be considered in providing medical and hospital care to the aged public assistance recipient.

The chairman of the working group on physical and mental health was Dr. S. D. Pomrinse, chief, Health of the Aged, Division of Special Health Services, Public Health Service. Dr. C. J. Ruilmann, Tennessee commissioner of mental health, and Steven Horvath, professor of physiology and acting director of the Institute of Gerontology, State University of Iowa, were group leaders.





# Rural Health Survey of Men Over Forty

By JOHN PEMBERTON, M.D., and KENNETH I. E. MACLEOD, M.D., M.P.H.

APPLICATION of preventive medicine to the later years of life is gaining attention from public health agencies. This is partly due to the remarkable decline in the mortality of children and young adults, which has brought the problems of morbidity and mortality in middle life into prominence, and partly to the failure of therapy in preventing the alarming rise in the death rates from certain diseases, such as coronary thrombosis and cancer of the lung, which bear most heavily on men in middle and later life.

A survey in 1955 was designed to find out something about the state of health, especially of the heart and lungs, of a group of men over the age of 40 who were living in a rural community. The study population, living or working in 6 of 16 towns of the Nashoba Health District in Massachusetts, was composed of all the men in the chosen age group who wished to be examined.

Altogether, 642 men came for examination. From many occupational classes, they included

physicians, bankers, priests, farmers, school teachers, clerks, and industrial workers of various grades of skill. The factories in which these men worked were small, long-established concerns situated in rural townships ranging from 500 to 4,000 in population. The plants included a tannery, two paper mills, a cordage factory, a cutlery works, and a plant manufacturing elastic underwear.

The participation rate from the factories was high. From information about the number in the eligible age group in two factories, where this point was checked, it was found that 47 out of 54 had come from one factory and 50 out of 52 from the other. There is, therefore, reason to believe that the sample was representative. Of course, those who were unable to come because of sickness or disability were necessarily excluded.

Participation was encouraged by vigorous preliminary publicity organized by a women's committee, utilizing press and radio, and the response was almost overwhelming.

The survey lasted for 3 weeks. In addition to daily sessions, several evenings were devoted to examinations for the convenience of the industrial workers.

## Examination Procedures

A public health nurse recorded each patient's history of past illnesses, occupation, residence, and habits of tobacco smoking. The subject was weighed in indoor clothes and his height measured with his shoes on. Subsequently, 3 pounds was subtracted from the weight and three-fourths of an inch from the height.

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*Dr. Pemberton is a senior lecturer in social and industrial medicine in the University of Sheffield, England. From 1954 to 1955 he was a Rockefeller traveling fellow in medicine. Dr. Macleod is commissioner of public health in Worcester, Mass., and instructor in public health practice in the Harvard School of Public Health. He was formerly medical director for the Nashoba Associated Boards of Health, Ayer, Mass.*

*The assistance of the American Cancer Society made the survey possible.*

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A full-sized standard chest X-ray was taken. The Massachusetts Department of Public Health provided the chest X-ray machine and radiographers, and Dr. Marriam W. Perry of the State health department read the films. Helping organize the project were members of the Nashoba Health District Chest Survey Committee.

After the films were taken, each man was examined by one of the physicians with special reference to pulmonary disease. This examination included a respiratory function test, the 1-second timed vital capacity, to help detect emphysema (1). This test measures the vital capacity and also the proportion of the vital capacity which can be expired during the first second of a forcible expiration following a maximum inspiration. Finally, the subject was examined by the other physician with special attention to the cardiac system. This examination included measurement of the blood pressure with the subject in a sitting posture after a 5-minute rest. Whenever an abnormality requiring treatment was discovered, the subject was advised to see his private physician, to whom a report was sent.

The record sheets were designed to facilitate statistical analysis. The data were coded, transcribed, and punched on cards. Of the 642 records, 42 were incomplete, usually because the subject had failed to enter one examination room in his tour and had not been missed until after he had gone home. Thus, 600 completed records were available for analysis.

In selecting the data for presentation, we

**Table 1. Number and percent of study group, by age, Nashoba Health District, Massachusetts**

Age	Number	Percent
35-39.....	5	0.8
40-44.....	157	26.2
45-49.....	114	19.0
50-54.....	96	16.0
55-59.....	82	13.6
60-64.....	68	11.3
65-69.....	40	6.7
70-74.....	22	3.7
75-79.....	10	1.7
80-84.....	3	.5
85-89.....	3	.5
Total.....	600	100.0

**Table 2. Number and percent of study group, by occupational class**

Occupational classifications	Number	Percent
I. Unskilled labor.....	56	9.3
II. Semiskilled labor.....	196	32.7
III. Skilled labor.....	135	22.5
IV. Clerical.....	20	3.3
V. Retail proprietors, school teachers, and administrators.....	130	21.7
VI. Higher income professions.....	32	5.3
VII. Retired.....	30	5.0
Not recorded.....	1	.2
Total.....	600	100.0

have confined ourselves mainly to those conditions which were common, and we examined their prevalence in relation to certain identifiable characteristics such as age, weight, occupational class, and smoking habits.

### General Characteristics

A wide range of ages were represented, but the sample consisted mainly of the middle-aged (table 1). About 85 percent were between the ages of 40 and 65. Five men were under the age selected for study.

There were no nonwhite men in the sample. Eighty-five percent were born in the United States, 6 percent in Canada, and 9 percent in Europe.

Six occupational classes were represented, with semiskilled and skilled workers predominating. Only 5 percent of the men had retired (table 2).

The great majority of the sample had always, or nearly always, lived in rural neighborhoods: 79.2 percent had spent less than one-tenth of their lives in cities of 100,000 population or more.

### Tobacco Smoking

Table 3 shows the smoking habits of the sample for two age groups and for all ages. Of the lot, 28.8 percent were either nonsmokers or ex-smokers. Heavy cigarette smokers, defined as those smoking 20 or more cigarettes a day, were 38.3 percent of the total. The older men smoked less than the younger. A higher pro-

portion of those aged 55 or over had never smoked or had given up smoking, and the percentage of heavy cigarette smokers in the older group was only half that in the younger group. More older than younger men limited their smoking to a pipe or cigars.

The 89 ex-smokers were asked when they had abandoned the habit and for what reasons. There was evidence that the rate of giving up smoking had increased in recent years. More than a third of the ex-smokers had given up the habit during the 4 years immediately preceding the survey. Of the 55 who gave a reason for quitting, 18 said they did so to try to get rid of a cough, 10 stopped on medical advice, 2 quit after a surgical operation, and 24 gave non-medical reasons. Only one asserted that he stopped smoking because of publicity on cancer of the lung.

### Pulmonary Conditions

There were 13 cases of pulmonary tuberculosis suspected on the basis of the full-sized chest films. Of these, only one was ultimately found to be active. Three were of doubtful activity.

Chest radiography disclosed two suspected cases of neoplasm. One man was found to have a benign tumor of the lungs, which was successfully excised. The other, at the time of writing, had failed to consult his physician.

The prevalence of chronic nontuberculous pulmonary disease in the different age groups appears in table 4. The definitions of the dis-

eases listed and a description of the diagnostic methods are published elsewhere (2).

Approximately three-fourths of each age group had no detectable pulmonary condition. Primary asthma was ascribed if there was a history of typical asthmatic attacks starting before the age of 25. This condition was not rare and was fairly evenly distributed in the age groups studied. The last three groups in the table represent increasing degrees of severity of chronic respiratory disease which, when fully developed, may be called chronic bronchitis, emphysema, and bronchial spasm. In its fully developed form it was uncommon under the age of 65.

Smokers' cough was the term applied to cough symptoms in those men who were heavy smokers if the answer to the first of the following questions or to any four of the others was "yes" and if no other cause for the cough was found:

- Does the cough go if you give up smoking?
- Does the cough get less if you give up smoking?
- Do you think the cough is due to smoking?
- Is it a dry cough?
- Is the cough the same in the winter and the summer?
- Is it largely confined to the first hour after rising?
- Is the cough largely associated with the first cigarette?

The prevalence of smokers' cough diminished with advancing age. This may be related to the smaller proportion of heavy cigarette smokers in the older age groups (table 3).

Table 3. Tobacco smoking habits in study group, by age

Age	Total	Never smoked		Ex-smokers		Cigarettes per day										Pipe or cigar only or both		Unrecorded	
						5 or less		About 10		About 20		About 30		40 or more					
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	600	84	14.0	89	14.8	50	8.3	53	8.8	162	27.0	42	7.0	26	4.3	91	15.2	3	0.5
35-54	372	47	12.6	44	11.8	32	8.6	29	7.8	120	32.3	33	8.9	21	5.6	44	11.8	2	.5
55-89	228	37	16.2	45	19.8	18	7.9	24	10.5	42	18.4	9	3.9	5	2.2	47	20.6	1	.4

The relationship between cigarette smoking and chronic respiratory disease, excluding the 72 men with smokers' cough, appears in table 5. The frequency of chronic nontuberculous respiratory disease increased consistently through the various grades of smoking, from 4.8 percent in the nonsmokers to 29.4 percent in the heavy cigarette smokers. (The  $X^2$  test showed that this association of chronic nontuberculous respiratory disease with tobacco smoking was highly significant,  $P > 0.001$ ).

### Respiratory Function

There was an interesting association between tobacco smoking and respiratory function as measured by the timed vital capacity test (table 6).

The incidence of abnormally low vital capacity was considerably lower in the lifelong nonsmokers than in the other groups. The differences, however, did not quite reach the conventional 5 percent level of statistical significance. To measure the relationship between the vital capacity measurements and tobacco smoking history, the man's vital capacity was expressed as a percentage of the value predicted for him by use of the formula of Baldwin Courmand, and Richards (3). More of the smokers had abnormally low vital capacities than the nonsmokers or ex-smokers; but, again the differences were not statistically significant.

It was found that 51 out of 233 heavy cigarette smokers gave a history of wheezing (21.9 percent) compared with 12 out of 171 nonsmokers or ex-smokers (7.0 percent). The

Table 4. Chronic nontuberculous pulmonary disease in study group, by age

Condition	Age								Total	
	35-44		45-54		55-64		65 and over			
	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent
Normal.....	118	72.8	155	73.8	101	69.3	56	71.8	433	72.2
Smokers' cough.....	25	15.4	29	13.8	15	10.0	3	3.8	72	12.0
Primary asthma.....	1	2.5	4	1.9	3	2.0	2	2.6	13	2.1
Emphysema or bronchial spasm alone or together.....	4	2.5	7	3.3	11	7.4	3	3.8	25	4.2
Chronic bronchitis alone or with emphysema or bronchial spasm.....	8	4.9	11	6.7	12	8.0	5	6.4	39	6.5
Chronic bronchitis with emphysema and bronchial spasm.....	3	1.9	1	.5	5	3.3	9	11.6	18	3.0
Total.....	162	100.0	210	100.0	150	100.0	78	100.0	600	100.0

Table 5. Tobacco smoking and chronic nontuberculous respiratory disease, excluding smokers' cough, in study group

Condition	Nonsmokers		Ex-smokers		Pipe or cigar only or both		Cigarettes per day				Total	
							Less than 20		More than 20			
	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent
Normal.....	80	95.2	80	89.9	76	86.4	77	79.4	120	70.6	433	82.0
Chronic nontuberculous respiratory disease.....	4	4.8	9	10.1	12	13.6	20	20.6	50	29.4	95	18.0
Total.....	84	100.0	89	100.0	88	100.0	97	100.0	170	100.0	528	100.0

difference between these percentages was statistically highly significant.

The occupational and residential histories failed to reveal that more than a few had ever been exposed to harmful dust in their work or to air polluted by urban industry. It is assumed, therefore, that these factors had no significant part in the etiology of chronic respiratory ailments.

### Cardiac Conditions

Twenty-three of the men were under the care of a private physician because of known heart disease, usually coronary artery disease. An additional 10 reported that they had had a previous coronary thrombosis from which they had recovered. These 33 cases represented only the gross manifestations of cardiac disease. There were probably additional patients whose symptoms had not caused them to consult a physician.

Special questions were introduced soon after the start of the survey to detect the presence of angina pectoris. Altogether, 42 of 407 questioned (10.3 percent) gave a typical history of pectoral angina precipitated by effort.

The percentage of heavy cigarette smokers (20 or more a day) among those with angina pectoris was 40.5 percent, nearly the same as the percentage among those without angina, 41.6.

There was no significant difference in the distribution by occupational class among those with angina pectoris and those without. There was a significantly higher proportion with enlargement of the heart (diagnosed by the chest roentgenogram) in the subjects with angina

pectoris than in those without. And a greater proportion of those with angina pectoris had systolic blood pressures of 160 mm./Hg or more and diastolic blood pressures of 100 mm./Hg or more than in those without. The differences in this case, however, did not reach the conventional level of statistical significance.

### Overweight

Overweight was assessed by reference to average values of weight for given ages and heights, based on recent tables of mean weights at different heights and ages (4). All those who, at a given height and age, exceeded the mean weight by 10 percent or more were termed overweight. This group was further subdivided into those who were 10-19 percent overweight and those who were 20 percent or more overweight (table 7). Of the 600 subjects, 24 percent were overweight. More than 1 out of 10 exceeded by 20 percent or more the mean weight for age and height. The highest prevalence of overweight was found in the years 55-64. The apparent fall after this age may be attributed to a tendency for people to lose weight after the age of 64 or to higher mortality rates among those who are overweight. The association of certain signs of ill health with overweight was scrutinized.

Systolic and diastolic hypertension, pitting edema of the ankles, and a low vital capacity were more common among the overweight persons than among those of normal weight. The differences in these rates, however, did not reach the conventional level of statistical significance. Angina pectoris was equally common in those

Table 6. Tobacco smoking and the 1-second timed vital capacity in study group

Timed vital capacity	Nonsmokers		Ex-smokers		Pipe or cigar only		Cigarettes per day				Total	
							Less than 20		More than 20			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Abnormally low (less than 65 percent).....	3	3.6	8	9.0	8	8.8	9	8.7	30	12.9	58	9.7
Normal (65 percent +).....	81	96.4	81	91.0	83	91.2	91	91.3	203	87.1	512	90.3
Total.....	84	100.0	89	100.0	91	100.0	103	100.0	233	100.0	600	100.0

who were overweight and in the remainder. There was no association between overweight and occupational classification. The percentage of overweight persons in classes I and II combined was 23.8; in class III, 25.3; and in classes V and VI, 25.3. There was a slightly lower percentage of overweight subjects among the heavy smokers.

### High Blood Pressure

High blood pressure is often regarded as inimical to a long and healthy life, although

surveys of this type usually disclose a considerable number of symptomless individuals with high blood pressure readings, who appear to be in robust health and may indeed be of advanced age. Table 8 shows the distribution of systolic and diastolic pressures by age. The proportion with high systolic pressures (160 mm./Hg or over) increased steadily with advancing age. The proportion with diastolic blood pressures of 100 mm./Hg or more increased with advancing age until age 64 and then leveled off.

The analysis revealed no relationship between

Table 7. Number and percent overweight in study, by age

Overweight group	Age								Total	
	35-44		45-54		55-64		65+		Number	Percent
	Number	Percent	Number	Percent	Number	Percent	Number	Percent		
10-19 percent above average weight for height and age.....	22	13.6	27	12.9	26	17.3	4	5.1	79	13.2
20 percent or more above average weight for height and age.....	15	9.3	15	7.1	22	14.7	13	16.7	65	10.8
Total overweight.....	37	22.8	42	20.0	48	32.0	17	21.8	144	24.0
Total normal weight.....	125	77.1	168	80.0	102	68.0	61	78.2	456	76.0
Total all weights.....	162	100.0	210	100.0	150	100.0	78	100.0	600	100.0

Table 8. Systolic and diastolic blood pressure in study group, by age

Blood pressure (mm./Hg)	Age								Total	
	35-44		45-54		55-64		65+		Number	Percent
	Number	Percent	Number	Percent	Number	Percent	Number	Percent		
<i>Systolic</i>										
80-159.....	154	95.0	180	85.7	104	69.3	47	60.3	485	80.8
160-179.....	5	3.1	18	8.6	25	16.7	14	17.9	62	10.3
180-249.....	3	1.9	9	4.3	20	13.3	17	21.8	49	8.2
Unrecorded.....	0	.0	3	1.4	1	.7	0	.0	4	.7
Total.....	162	100.0	210	100.0	150	100.0	78	100.0	600	100.0
<i>Diastolic</i>										
0-99.....	148	91.4	177	84.3	116	77.3	62	79.5	503	83.8
100-119.....	13	8.0	26	12.4	25	16.7	11	14.1	75	12.5
120-149.....	1	.6	4	1.9	8	5.3	5	6.4	18	3.0
Unrecorded.....	0	.0	3	1.4	1	.7	0	.0	4	.7
Total.....	162	100.0	210	100.0	150	100.0	78	100.0	600	100.0



high systolic or diastolic blood pressure and occupational class or between high blood pressure and heavy cigarette smoking.

## Discussion

The survey was limited in scope. Its major emphasis was on the discovery of chronic pulmonary and cardiac disease in a sample of men residing in a rural area. They were not chronically exposed to the crowding and air of cities. They seemed reasonably prosperous, and, in the six factories we visited, the conditions of work appeared healthful.

On the whole, their health was favorable. There was little significant pulmonary tuberculosis. There were those with frank cardiac disease, as would be expected at these ages, and no doubt a further number with incipient cardiovascular conditions.

Chronic cough, if smokers' cough is included under this heading, was common. An attempt was made to distinguish chronic bronchitis cases in the group with coughs. When this was done, it appeared that approximately 10 percent of the whole sample had chronic bronchitis. In only 3 percent of the sample, however, did we find the fully developed syndrome of chronic bronchitis, emphysema, and bronchial spasm. Half of the 18 severe cases occurred in men over 65. Before this age, it was rare. The prevalence rate of chronic nontuberculous respiratory disease (excluding smokers' cough) was significantly and directly correlated with tobacco smoking. The relatively large proportion of smokers and ex-smokers with abnormally low 1-second timed vital capacities compared with lifelong non-smokers suggests a relationship between tobacco smoking and pulmonary function. Whitfield, Arnott, and Waterhouse (5) found evidence that tobacco smoking reduces the vital capacity and increases the ratio of residual air to total lung volume, and both Palmer (6) and Oswald and Medvei (7), in studies of large unselected population groups, found a direct relationship between the amount of cigarette smoking and the prevalence of chronic bronchitis.

The other most striking finding in this survey was the high prevalence of overweight. Life

insurance statistics have shown that overweight policyholders are more likely than those of normal weight to die of diabetes, diseases of the biliary tract, appendicitis, nephritis, cerebral hemorrhage, cirrhosis of the liver, heart disease, hernia, and intestinal obstruction (8). Among the overweight in this sample, there were higher prevalence rates of high blood pressure, pitting edema of the ankles, and low vital capacities, and there were fewer heavy cigarette smokers. None of these differences, however, reached the conventional level of statistical significance. There was no relationship between overweight and occupational class or between overweight and angina pectoris. Keys (9) has reported a similar lack of association between overweight and coronary artery disease.

The small sample we examined failed to show any significant impairment of health that might be attributed to a deficiency in diet, shelter, or working environment. On the other hand, it is possible that the heart, respiratory, and overweight conditions observed may be attributed in part to a contemporary mode of living. Relative affluence, associated with full employment at attractive wages, permits diets abounding in fats and of as many cigarettes as time permits. The ubiquitous automobile and other forms of power machinery materially reduce the need to burn fats by physical exertion. It may be suspected then that a mode of living no less than aging contributes to certain afflictions characteristic of middle and later life. Identification of such immediate, as well as earlier, sources of impairment to health is a new task for preventive medicine.

## Summary

Among 600 middle-aged and elderly men living in a rural area of Massachusetts, chronic cough, including "smokers' cough," was found to be common. Excluding cases of smokers' cough, there was a direct and significant relationship between tobacco consumption and the prevalence of nontuberculous chronic respiratory disease.

Only one case of active pulmonary tuberculosis was discovered.

Heart disease was not uncommon, and 3.6 percent were seeing a physician for this condition.

There were in addition, 10 men who had recovered from a previous coronary thrombosis.

Overweight was common; 13 percent were 10-19 percent above their expected weight for height and age, and a further 11 percent were 20 percent or more overweight.

It is concluded that conditions of prosperity may favor the development of certain diseases as was the case in the past and that a study of this relationship constitutes an important field for preventive medicine.

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## Center for Aging Research

In recognition of the urgent need to solve the special health problems of an aging population—the number of citizens over age 65 is expected to surpass 18 million by 1970—the Public Health Service on October 30 created a Center for Aging Research in the National Institutes of Health.

The center will coordinate research activities in the institutes and will stimulate additional research into the mechanisms involved in aging. Dr. G. Halsey Hunt, former associate chief of the Bureau of Medical Services has been named to direct its activities.

The new center is part of the Public Health Service's accelerated activities in the field of aging. Dr. John W. Porterfield, Assistant Surgeon General, will direct and coordinate all of the Service's activities in this field.

The Public Health Service has long been concerned with the health problems of the aging. In State and local health departments, restorative services for the aged are being supported in part by the Bureau of State Services. The major research effort of the Service has been centered in the National Institutes of Health, which at present is expending about \$2 million in its own research activities and in grant support of projects directly related to aging.

The accelerated programs will encourage and support research institutions in bringing the full range of biological, psychological, and social sciences to bear on the problem of aging. Part of the support to be provided by the Service will be in the form of research grants that will assist universities, medical schools, and other research institutions in establishing research centers on aging.



# Blindness Among the Aged

By NEDRA B. BELLOC, M.A.

VISUAL ACUITY may be likened to a spectrum, ranging from normal or perfect vision at one end to total blindness or absence of light perception at the other. In a discussion of the extent of "blindness" in the aged population, it is necessary to remember that we are dealing with an arbitrarily defined group that includes only those with severe visual loss. The most widely accepted definition of "economic blindness" is that used in the administration of many programs of aid to the blind. Under this definition a person is blind if the vision of the better eye with best possible correction is 20/200 or less, or if he has a field defect in which the widest diameter of the visual field subtends an angular distance no greater than 20°. Persons in this group and many others with less loss of vision bear an inestimable burden in the social and occupational adjustments which their handicap requires of them.

How many aged persons are blind? How long have they been blind? What caused their blindness? These and other questions confronted the California State Department of Public Health when, in 1954, it received a grant from the W. K. Kellogg Foundation for a project in the prevention of blindness.

## The Prevalence of Blindness

The literature reveals that most surveys of blind persons have been limited to recipients of

aid from one of the programs for the needy blind (1-9). Notable exceptions are New York and North Carolina, which have registers of blind persons (10-11).

The most widely used estimates of the prevalence of blindness are those of Hurlin (12) and are based on the assumptions that the rates will vary with age and race composition and with the public health standards of the States.

Data on the incidence of blindness are almost entirely lacking and, except where registers exist, must be inferred from prevalence figures (13).

During the year May 1954-April 1955, the California State Department of Public Health conducted a survey of a sample of about 10,000 households throughout the State. Data collected included population characteristics, illnesses, accidents, chronic conditions, and receipt of medical care. Interviewers handed respondents a list of chronic conditions which included blindness and asked, "Has anyone in the family had any of these conditions during the past 12 months?" The interviewers then read each condition aloud and paused for the respondent's reply.

Responses which indicated losses of vision more severe than those due to refractive errors were later coded as blindness, partial blindness, or vision impairment. The coding was done with the aim of producing an underestimate of blindness. Admittedly, some persons who were classified as blind may have better than 20/200 vision, but it is also likely that a larger number of those who were classified as partially blind are actually blind by the usual definition. It was apparent from the terminology of the responses, and from the comparisons which could

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be made with available medical records, that to most lay people blindness means absence of light perception.

The prevalence rates shown in table 1 for the population 65 years of age or over are probably conservative estimates of the extent of vision problems.

Because of the size of the sample (2,600 persons aged 65 and over), these rates are subject to rather large sampling errors, and differences between income groups are not statistically significant. (The sampling error for the rate of 1.4 is  $\pm 0.2$ .)

In North Carolina, which has kept a careful register of blind persons for some years, 2.25 percent of the population aged 65 and over was blind according to the most recent report (11).

Another approach to the problem of determining the prevalence of blindness among the aged is to examine the portion of the population that receives public assistance. In California, recipients of aid to the blind normally receive \$10 more per month than they would receive under the old age assistance program. This differential probably encourages qualified persons to apply for aid to the blind rather than for old age assistance. It is known, however, that some blind persons are receiving old age assistance.

In California in December 1954, 271,347 persons were receiving old age security (14), and 8,025 persons aged 65 or older were receiving aid to the blind. Thus, 2.9 percent of the indigent aged were receiving the pension for the

blind. In counties known to have a liberal policy regarding applications for aid to the blind, this percentage was slightly higher. A blindness rate of approximately 3 percent in the indigent aged is not inconsistent with the rate of 2 percent shown for the aged population with incomes under \$2,000 per year in the California Health Survey. One would expect the highest blindness rate to be in the indigent population since blindness so often leads to dependency.

Obviously, then, blindness, with a prevalence rate of between 1.5 and 3.0 percent of the aged population, does not concern as many people as arthritis or arteriosclerotic heart disease. However, its prevalence is about the same as diabetes or neuritis in this segment of the population, according to data gathered by the California Health Survey, and its impact on those affected is undoubtedly greater.

In surveying the possible sources of data in California, the project found that the largest single group of records on blind adults is available in the California State Department of Social Welfare, which, together with the county welfare departments, administers aid to more than 12,000 needy and partially self-supporting blind persons. No analysis had been made of these records since 1945 when the department of social welfare published a study based on the 1941 caseload (4). In December 1954 the project surveyed the causes of blindness in this group, using as a source the reports of eye examinations made by physicians. Almost two-thirds of the recipients were 65 years of age or over. The study included 1,605 persons in this age group, representing a 20 percent sample of those who were 65 years of age or over.

Persons receiving aid to the blind may not be representative of all the blind since some causes may occur more frequently among those in higher economic groups, but data on the self-sufficient portion of the blind population are not available.

#### Age at Onset

Blindness had its onset before the age of 25 years for only about 6 percent of the group, and for an additional 5 percent it began between 25 and 44 (table 2). For about one-third the

**Table 1. Prevalence rates of blindness, partial blindness, and impaired vision<sup>1</sup> among 2,600 persons, 65 years of age or over, by family income group, California Health Survey, 1954-55**

Family income group	Percent		
	Blind	Partially blind	Vision impaired
All groups-----	1.4	0.9	2.4
\$5,000 and over-----	1.5	1.9	1.1
\$2,000-\$4,999-----	.8	.4	2.8
Under \$2,000-----	2.0	.8	2.8

<sup>1</sup> Excludes correctible refractive errors and all unilateral conditions.

**Table 2. Age at onset of impaired vision for 1,605 recipients of aid to the blind, 65 years of age or older,<sup>1</sup> California, December 1954**

Age at onset (in years)	Total		Present age (percent)				
	Number <sup>1</sup>	Percent	65-69	70-74	75-79	80-84	85 and over
Total.....	1,605	100	100	100	100	100	100
Under 1.....	18	1.1	2.2	2.0	1.5	-----	0.3
1-4.....	12	.8	2.2	.3	1.2	.3	-----
5-14.....	40	2.5	4.0	3.4	3.4	1.8	.5
15-24.....	29	1.8	3.2	3.1	1.8	.6	.8
25-44.....	85	5.3	12.3	6.1	4.3	3.9	1.6
45-64.....	493	30.7	64.2	47.4	30.9	14.2	7.4
65 and over.....	867	54.0	6.5	33.4	54.7	74.7	86.2
Unknown.....	61	3.8	5.4	4.1	2.1	4.5	3.2

<sup>1</sup> A 20 percent sample of those receiving aid in December 1954.

SOURCE: Eye examination reports of the division for the blind in the California State Department of Social Welfare.

trouble began in late middle life, and for more than half (54 percent) the condition started after the age of 65. The onset of blindness represents a different problem in each of these age groups, and its prevention will therefore have a different meaning. For those blinded in childhood or youth, the problem is one of training for a self-sufficient and productive life in a sighted world. Preventive activities here save society the expense of either this additional training or of supporting a dependent person for his lifetime. For those blinded in the early years of maturity, the problem is one of readjustment and rehabilitation, again with costly periods of training and possible dependency. Blindness which occurs after the period when occupational rehabilitation is feasible is likely to result in dependency, and its prevention means, of course, a prolonging of the productive years.

### The Causes of Blindness

Tables 3 and 4 relate to the causes of blindness among this group of aged persons. Cataracts accounted for 35 percent of the blindness and glaucoma for another 16 percent. A large proportion of these cases are preventable or treatable. Next in importance were arteriosclerotic disease of the choroid and retina, with 11.3 percent, and retinal degeneration, with 7.5 percent (table 3).

General (systemic) diseases accounted for

**Table 3. Primary pathology of blindness<sup>1</sup> for 1,542 recipients of aid to the blind, 65 years of age or older, California, December 1954**

Pathology	Number	Percent
Total <sup>2</sup> .....	1,542	100.0
Glaucoma.....	246	16.0
Refractive errors.....	69	4.5
Structural anomalies.....	7	.4
Degenerative changes.....	16	1.0
Cornea:		
Keratitis.....	46	3.0
Pannus.....	30	1.9
Ulceration and vascularization.....	3	.2
Other affections of cornea.....	19	1.2
Iris:		
Iritis.....	1	.1
Iridocyclitis and uveitis.....	18	1.2
Other affections of iris.....	4	.3
Lens:		
Cataract.....	538	34.9
Other affections of lens.....	4	.3
Choroid and retina:		
Choroiditis.....	2	.1
Retinitis.....	56	3.6
Chorioretinitis.....	77	5.0
Detached retina.....	5	.3
Retinal degeneration.....	116	7.5
Arteriosclerotic disease of choroid and retina.....	175	11.3
Other affections of choroid and retina.....	2	.1
Optic nerve atrophy.....	86	5.6
Other.....	22	1.4

<sup>1</sup> Last eye to go blind. When age at onset was the same in both eyes, but different pathologies were given, pathology for the right eye was used.

<sup>2</sup> A 20 percent sample of those receiving aid. Excludes 63 cases for which a report of pathology was not available.

SOURCE: Eye examination reports of the division of the blind in the California State Department of Social Welfare.

**Table 4. Etiology of blindness<sup>1</sup> for 1,542 recipients of aid to the blind, 65 years of age or older, by sex, California, December 1954**

Etiology	Males	Females
Total number <sup>2</sup> -----	674	868
Total percent-----	100.0	100.0
Infections diseases-----	5.6	6.2
Syphilis-----	2.8	1.6
Ophthalmia neonatorum-----		.1
Trachoma-----	2.2	2.6
Tuberculosis-----	.1	.2
Meningitis-----		.1
Measles-----	.1	.5
Other-----	.3	1.0
Trauma and poisonings-----	6.4	2.0
Neoplasms-----	.1	-----
General (systemic) diseases, not elsewhere classified-----	13.4	19.5
Diabetes-----	1.3	4.7
Vascular diseases-----	12.0	14.0
Diseases of central nervous system-----		
Other-----		.7
Prenatal origin-----	1.6	.5
Etiology undetermined or unknown to science-----	72.8	71.9
Cataract <sup>3</sup> -----	35.3	32.5
Glaucoma <sup>3</sup> -----	11.7	16.5
Other-----	22.8	22.9

<sup>1</sup> Last eye to go blind. When age at onset was the same for both eyes, but different etiologies were given, etiology for the right eye was used.

<sup>2</sup> A 20 percent sample of those receiving aid. Excludes 63 cases for which a report of etiology was not available.

<sup>3</sup> Excludes cases for which etiology was known and which were placed in appropriate categories above.

SOURCE: Eye examination reports of the division for the blind in the California State Department of Social Welfare.

about half of the cases of known etiology, followed by infections diseases and accidents (table 4). Diabetes was a more prevalent cause among the women than men, while accidents and syphilis accounted for a higher proportion of the blindness among the men.

## Prevention

The etiology of the two major sources of blindness in older persons is unknown. Careful medical supervision and surgery at the appropriate time can, however, restore vision in a large portion of persons with cataract. Like-

wise, early detection and continued treatment of glaucoma can prevent loss of vision. For many in whom blindness is due to degenerative diseases, such as arteriosclerosis and diabetes (15), preventive activities must wait for further advances in medical knowledge (10). Fortunately, effective control measures are operating to reduce the toll of blindness caused by many of the infections diseases such as syphilis, tuberculosis, trachoma, and measles. Ophthalmia neonatorum, which 50 years ago accounted for more than one-fourth of the blindness in school-age children, has, by the routine use of prophylactics at birth, been almost eliminated as a cause of blindness in infants (16). Adequate prenatal care, especially in the early months of pregnancy, may help to reduce the numbers of cases of congenital blindness. Educational work in the broad field of accident prevention will also help to prevent the loss of sight due to trauma.

## Summary

Studies of the extent and causes of blindness in California indicate blindness in about 3 percent of the persons aged 65 and over who are receiving public assistance. More than half of these recipients of aid became blind after age 65 and about one-third in late middle life. Cataracts and glaucoma together accounted for more than half of the cases, followed by general diseases, infectious diseases, and accidents. Although the specific causes of cataracts and glaucoma are not known, much of the blindness from these conditions can be prevented by careful medical supervision and treatment. Preventive activities under way in the fields of infectious disease control and accidents are hopeful indicators of decreasing incidence of cases of blindness from these causes.

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## Glaucoma After Forty

With advancing years as physical activity becomes somewhat curtailed, our ability to read newspapers, books, and to observe television becomes increasingly important to our emotional well-being. Dr. Peter C. Kronfeld, speaking before the National Society for the Prevention of Blindness in Chicago March 28, 1956, indicated that in the population over 40 years of age chronic glaucoma occurs with a frequency of 1 to 2 percent. Unfortunately the silent character of this disease means that unless it is looked for specifically it may have progressed to such a point that it has caused irreparable damage. If it is detected during the first 2 years, the permanent visual damage is slight and a good therapeutic result can be anticipated.

Industrialists have been cognizant, through industrial safety programs, of the need for protecting the vision of those engaged in hazardous occupations, but some of these same industries have offered relatively little to their office and clerical personnel. Those with experience in this field tell me that when eye fatigue is minimized there is an actual increase in employee efficiency with improvement in equanimity. We have not done the many things that could be done to minimize eye fatigue.

—HAROLD M. GRANING, M. D., *regional medical director with the Public Health Service, Region 5, Chicago, addressing the 1956 Middle States Health Conference.*

# Occurrence of Influenza

## July 1955 to June 1956

By DORLAND J. DAVIS, M.D., Dr.P.H.

**D**URING the period July 1, 1955, to June 30, 1956, the incidence of influenza was comparatively low in the United States. Although influenza A predominated, the small outbreaks of this type were sporadic and localized. There were, however, occasional sharp outbreaks in the east, midwest, and west during the late winter months of 1956. Clinically, the disease was mild, and no unusual mortality was associated with it. Influenza B was reported less frequently than in the previous 2 years. Influenza C was recognized principally in the late winter and early spring.

Of more than usual interest was an outbreak of specifically diagnosed influenza A during July 1955 in a penal institution at Hagerstown, Md. The cases were first noted July 18 and continued for 3 weeks. A total of 350 cases of respiratory illness occurred among 900 inmates, from a number of whom influenza A virus was recovered. No further outbreaks were recognized in the United States until the winter months, although serologic evidence of sporadic infections in military installations was found in November.

In England during December, influenza A infection was diagnosed among American school children at an Air Force base and also in scattered parts of the south of England as out-

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*Dr. Davis for the past 6 years has been executive secretary of the Influenza Information Center, WHO Influenza Study Program in the United States, National Institutes of Health, Bethesda, Md. He is associate director in charge of research, National Institute of Allergy and Infectious Diseases, Public Health Service. In the November 1955 issue of Public Health Reports, Dr. Davis discussed the occurrence of influenza for the period July 1954 to June 1955.*

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### Reporting System

Current information on the occurrence of specifically diagnosed influenza and suspected outbreaks of influenza-like disease is published each week in the Communicable Disease Summary of the National Office of Vital Statistics, Public Health Service, and is distributed to health agencies in the United States and other countries. This is part of a worldwide effort sponsored by the World Health Organization to improve the reporting of influenza and to encourage exchange of newly isolated strains of influenza virus for investigational purposes.

In the United States, research laboratories, hospitals, and Federal and State agencies, including Army, Navy, and Air Force installations, report the observations to the Influenza Information Center of the WHO Influenza Study Program in the United States.

Dr. Carl C. Dauer, medical adviser of the Office of Vital Statistics, Public Health Service, is now executive secretary of the Influenza Information Center. The International Influenza Center for the Americas will continue under the direction of Dr. Keith E. Jensen at the Virus and Rickettsia Section, Laboratory Branch, Communicable Disease Center Activities, Montgomery, Ala.

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breaks of relatively mild intensity. A few serologically recognized cases continued to occur during December in the United States.

In January, two sporadic cases of influenza A were diagnosed by virus isolation in the vicinity of Washington, D. C., but the incidence never attained unusual proportions.

During February, localized outbreaks of varying intensity were recognized in upstate New York; Pennsylvania; Cleveland, Ohio; and Illinois. Influenza A virus was recovered from some cases. In Herkimer and Fulton Counties, N. Y., the incidence of influenza was high enough to be reflected in a school absentee rate of 40 percent, but this rate did not obtain in other areas. California reported a number of serologically confirmed cases from the north central part of the State and the San Francisco area.

In March, specifically diagnosed influenza A continued to be recognized from the San Francisco area and also from the southern part of



**Isolations of influenza virus and positive diagnostic serologic tests (any technique) reported by civilian and military laboratories participating, continental United States and Alaska**

Month and year	Isolation of virus, type			Routine serologic tests, type		
	A	B	C	A	B	C
<i>1955</i>						
November-----	0	0	0	2	12	0
December-----	0	0	0	3	5	1
<i>1956</i>						
January-----	6	0	0	30	4	0
February-----	14	0	0	73	4	0
March-----	11	0	1	138	4	6
April-----	1	0	0	17	0	6
May-----	0	0	2	4	2	6
Total-----	32	0	3	267	31	19

California. However, it was not of the same order as that which occurred in 1953 or 1951 and clinically was not severe. Minnesota experienced a low incidence, most noticeable as a respiratory disease outbreak on a hospital ward. Influenza A virus was recovered in several instances. A localized outbreak of rather sharp intensity was also recognized in Hamilton, Mont., during this period. New York and other areas of eastern United States continued to report sporadic cases or small outbreaks.

California continued to report a few cases of influenza A in the month of April. In May, influenza C occurred sporadically at Great Lakes Naval Training Center, Ill., and 2 strains of virus were recovered from patients.

Of interest was the occurrence in Jamaica, B. W. I., of influenza A during December and January. Although the cases were described as moderately severe clinically, no unusual death rate was noted.

The mortality in the United States from all causes and from influenza and pneumonia did not reflect the occurrence of influenza A infec-

tion nor show any excess over that expected for winter months.

The strains of influenza A recovered from patients were antigenically similar to each other and to those recovered in the last several years in this country, including the A/FLW/1/52, A/Malaya/302/54, and A/Albany/2/55 strains. Influenza C virus strains were found to be similar to those previously isolated since 1950.

In contrast with the preceding year, no isolation of influenza B virus was reported to the Influenza Information Center, although there were a few reports of serologically diagnosed infection with this type.

The table shows that a total of 32 strains of influenza A virus and 3 strains of influenza C virus were reported as recovered in the United States during this time. By serologic means, 267 specific diagnoses of influenza A, 31 of influenza B, and 19 of influenza C were made. The distribution by months in this table has little significance because of the widespread sources and the small number of reports.



*Roentgenographic findings support the conclusion that fluoridation of a municipal water supply results in a substantial reduction in dental caries among children.*

# Clinical and Roentgenographic Examinations for Dental Caries in Grand Rapids, Mich.

By RICHARD L. HAYES, D.D.S., H. BERTON McCAULEY, D.D.S., and FRANCIS A. ARNOLD, Jr., D.D.S.

DENTAL CARIES experience may be estimated by direct clinical observation, by roentgenography, or by a combination of the two methods. Direct observation is most convenient and is therefore most frequently employed, but the demonstration that bite-wing roentgenography is valuable for early detection of caries in the approximal surfaces of the teeth (1-7) has led to its use in several studies (8-14), including some in which it was the only method used. The combined technique, direct observation plus bite-wing roentgenography, consistently yields a higher estimate of caries prevalence than direct observation alone (7, 10-12); therefore, some observers

have suggested that X-rays are essential for dental surveys designed to determine the efficacy of caries control measures (8, 12, 15).

In Grand Rapids, Mich., a study to evaluate fluoridation of a municipal water supply as a caries control measure has been in progress since 1944. As part of this study, an investigation was undertaken to determine whether or not supplementing direct observation with roentgenographic examination would affect the conclusions based on direct observation alone. Caries experience was estimated separately by direct observation and by bite-wing roentgenography. The data were then combined in such manner that, if the conclusions were affected, it would be evident, and if not, the finding would be unequivocal. Hence, the method selected for combining the data gives the greater weight to the roentgenographic findings and presents the direct observation findings adversely. The roentgenograms were used also to estimate the depth of the carious lesions.

## Methods

Each year since the start of fluoridation in Grand Rapids in January 1945, selected samples of school children have received direct observation examinations for dental caries. The

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examinations are performed by several dentists, using a mouth mirror, an explorer, and artificial illumination (16, 17).

In 1946, 1947, and 1953 (approximately 21, 33, and 105 months after fluoridation was begun), the annual dental examinations of children in the first, fourth, and eighth grades of four selected schools were supplemented by bite-wing X-rays. The X-ray examinations followed the regular examinations by a period varying from a few days to a month. Left and

right posterior bite-wing radiographs were made for every pupil. For each fourth-grade child (8-10 years of age), one anterior bite-wing X-ray was made to show the central incisor teeth; for each eighth-grade child (12-14 years of age), three anterior bite-wing X-rays were made to show the incisor and cuspid teeth. First-grade pupils (5-7 years of age) did not receive anterior bite-wing X-rays.

Roentgenographic interpretation was limited to the approximal surfaces of the deciduous

**Table 1. Mean number of carious teeth per child as estimated by direct observation and by direct observation plus X-ray examination, Grand Rapids, Mich., 1946-47 and 1953**

Type of examination	1946-47		1953		Difference	Standard error
	Mean	Standard error	Mean	Standard error		
def <sup>1</sup> deciduous molars (ages 5-7)						
Direct observation only-----	4.73	0.27	2.82	0.21	1.91	0.31
Direct observation plus:						
Minimum X-ray findings-----	5.67	.23	4.06	.23	1.61	.35
Maximum X-ray findings-----	6.19	.21	4.92	.23	1.27	.33
DMF <sup>2</sup> first permanent molars (ages 8-10)						
Direct observation only-----	2.77	0.16	1.86	0.13	0.91	0.22
Direct observation plus:						
Minimum X-ray findings-----	2.78	.16	1.93	.12	.85	.21
Maximum X-ray findings-----	3.04	.14	2.34	.12	.70	.19
DMF <sup>2</sup> permanent teeth (ages 12-14)						
Direct observation only-----	9.66	0.45	5.44	0.36	4.22	0.64
Direct observation plus:						
Minimum X-ray findings-----	10.96	.46	6.50	.41	4.46	.69
Maximum X-ray findings-----	13.26	.50	8.73	.52	4.53	.78
DMF <sup>2</sup> premolars (ages 12-14)						
Direct observation only-----	1.51	0.18	0.38	0.09	1.13	0.22
Direct observation plus:						
Minimum X-ray findings-----	1.90	.20	.73	.11	1.17	.24
Maximum X-ray findings-----	3.34	.22	2.08	.20	1.26	.31
DMF <sup>2</sup> first permanent molars (ages 12-14)						
Direct observation only-----	3.93	0.04	3.17	0.12	0.76	0.14
Direct observation plus:						
Minimum X-ray findings-----	3.96	.03	3.30	.11	.66	.13
Maximum X-ray findings-----	3.98	.02	3.43	.10	.55	.11

<sup>1</sup> Decayed, extraction indicated, or filled.

<sup>2</sup> Decayed, missing, or filled.

molar teeth of 5- to 7-year-old children, the central incisor and first permanent molar teeth of 8- to 10-year-old children, and the permanent teeth (excluding third molars) of 12- to 14-year-old children. Each set of roentgenograms received two independent readings. Each reading was made without reference to the clinical examination record and was recorded separately from the other.

The first step in recording the caries status of an approximal surface was to score it as

carious or noncarious. An approximal surface was scored as carious if the reader could detect a discontinuity of the enamel surface or any other sign of caries, such as an abnormal radiolucency at the dentino-enamel junction. These surfaces were designated as the maximum number of carious surfaces detectable by X-ray. Each carious surface was then further examined, and a separate notation was made for each one with signs of caries of the dentin. Surfaces with dentinal caries were designated

**Table 2. Mean number of carious approximal surfaces per child as estimated by direct observation and by direct observation plus X-ray examination, Grand Rapids, Mich., 1946-47 and 1953**

Type of examination	1946-47		1953		Difference	Standard error
	Mean	Standard error	Mean	Standard error		
df <sup>1</sup> approximal surfaces of deciduous molars (ages 5-7)						
Direct observation only.....	4.48	0.12	1.92	0.20	2.56	0.43
Direct observation plus:						
Minimum X-ray findings.....	6.11	.12	3.79	.26	2.32	.46
Maximum X-ray findings.....	7.21	.11	5.14	.29	2.07	.47
DF <sup>2</sup> approximal surfaces of first permanent molars (ages 8-10)						
Direct observation only.....	0.56	0.11	0.08	0.02	0.48	0.09
Direct observation plus:						
Minimum X-ray findings.....	.81	.14	.25	.05	.56	.13
Maximum X-ray findings.....	1.55	.16	1.02	.09	.53	.18
DF <sup>2</sup> approximal surfaces of permanent teeth (ages 12-14)						
Direct observation only.....	5.58	0.54	1.90	0.32	3.68	0.68
Direct observation plus:						
Minimum X-ray findings.....	8.60	.68	3.86	.45	4.74	.87
Maximum X-ray findings.....	13.07	.77	7.75	.66	5.32	1.08
DF <sup>2</sup> approximal surfaces of premolars (ages 12-14)						
Direct observation only.....	0.63	0.13	0.09	0.03	0.54	0.14
Direct observation plus:						
Minimum X-ray findings.....	1.38	.22	.53	.11	.85	.25
Maximum X-ray findings.....	3.43	.31	2.33	.26	1.10	.41
DF <sup>2</sup> approximal surfaces of first permanent molars (ages 12-14)						
Direct observation only.....	1.85	0.16	0.75	0.11	1.10	0.21
Direct observation plus:						
Minimum X-ray findings.....	2.45	.18	1.37	.14	1.08	.24
Maximum X-ray findings.....	3.34	.19	2.46	.19	.88	.27

<sup>1</sup> Decayed or filled deciduous teeth.  
<sup>2</sup> Decayed or filled permanent teeth.

Figure 1. Teeth with caries experience, continuous resident children in Grand Rapids, Mich., 1946-47 and 1953.

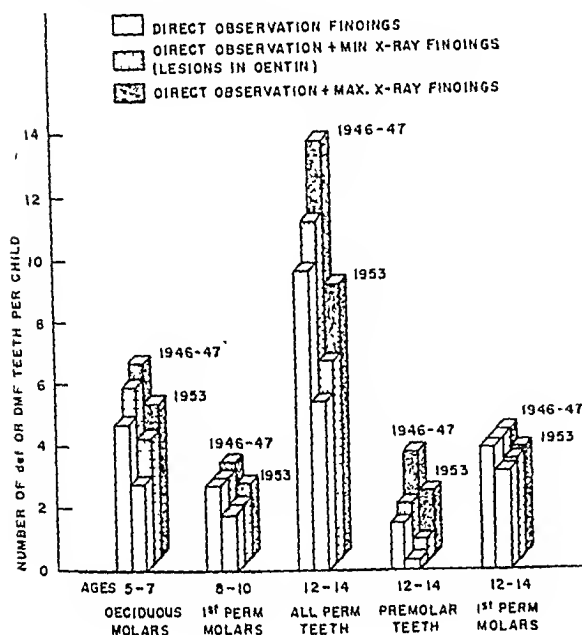
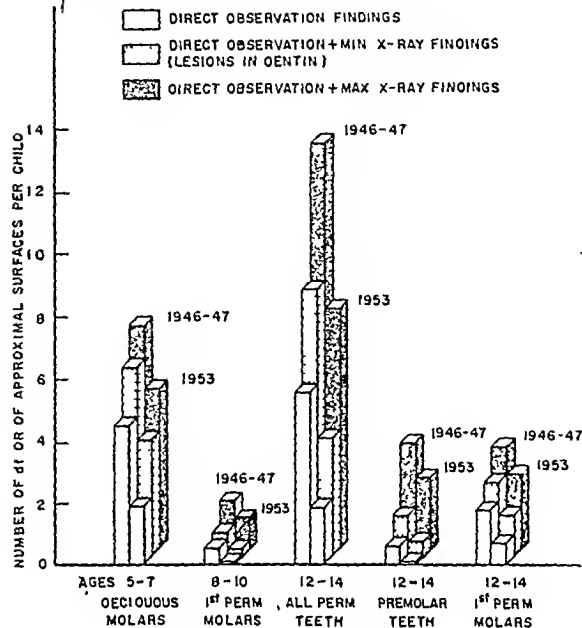


Figure 2. Approximal surfaces with caries experience, continuous resident children in Grand Rapids, Mich., 1946-47 and 1953.



as the minimum number of carious surfaces demonstrable by X-ray. Radiolucencies contiguous to restorations were not recorded, but restorations were considered caries of both the enamel and the dentin.

After the completion of all X-ray interpretations, a master record of the roentgenographic findings was made for each child. This record, which contained the notations from each of the independent readings, was used in combining the radiographic and clinical findings. To give greater weight to the radiographic findings, an approximal surface was given a roentgenographic diagnosis of caries if it was scored as carious at either reading.

Two more records were then made for each

child: one for direct observation findings plus minimum X-ray findings; the other for direct observation findings plus maximum X-ray findings. Surfaces negative for caries according to direct observation but positive according to X-ray examination were added to the direct observation findings. Surfaces positive according to direct observation were considered carious at both levels of penetration, regardless of the X-ray findings.

Only children designated "continuous residents," that is, those who had consumed water from the Grand Rapids supply continually since birth and who had not been absent from that community longer than 3 months in any calendar year, were included in the study, although

Table 3. Number of continuous resident children examined with bite-wing X-rays and mean age of children in each age group, Grand Rapids, Mich., 1946-47 and 1953

Age group (years)	1946-47				1953			
	Boys	Girls	Total	Mean age	Boys	Girls	Total	Mean age
5-7	58	50	108	6.2	70	71	141	6.4
8-10	50	41	91	9.1	89	79	168	9.4
12-14	59	54	113	13.3	55	60	115	13.3

**Table 4. Mean number of teeth per child subject to the risk of caries, Grand Rapids, Mich., 1946-47 and 1953**

Type of teeth and age group	1946-47	1953
Deciduous molars: 5-7	7.63	7.77
Permanent teeth:		
8-10	14.03	13.76
12-14	26.80	26.56
Premolars: 12-14	7.60	7.48

others were examined. Of those who received X-ray examination in addition to the regular examination, 736 (312 in 1946 and 1947, and 424 in 1953) met the residence requirements. As there was no essential difference in the caries experience of the 167 radiographed in 1946 and the 145 in 1947, the data for these 2 years were combined.

The representativeness of the X-ray sample was determined by comparing the caries experience of the children in this sample, as deter-

mined by direct observation of the teeth, with that of their age peers in the entire sample of children examined in 1946-47 and 1953 (18). Between 1946-47 and 1953 both samples displayed substantial decreases in the number of def (decayed, indicated for extraction, or filled) deciduous teeth and in the number of DMF (decayed, missing, or filled) permanent teeth. Both samples yielded essentially the same results.

#### Support for Clinical Findings

Supplementation of the dental examinations with bite-wing X-rays did not change the basic observation that decreases in dental caries occurred among the Grand Rapids children between 1946-47 and 1953. The mean numbers of carious teeth were smaller in 1953 than in 1947 whether estimated by direct observation alone or by direct observation plus X-ray examination (table 1 and fig. 1). The same was

**Table 5. Caries of approximal surfaces, by depth of lesion as determined by X-rays, Grand Rapids, Mich., 1946-47 and 1953**

Year(s)	Number of approximal surfaces present	Number of carious surfaces			Number of caries-free surfaces	Number of carious surfaces per 100 surfaces present		
		Total	Caries of dentin	Caries of enamel only		Caries of dentin	Caries of enamel only	Caries free
		Deciduous molars (ages 5-7)						
1946-47	1,648	756	622	134	892	37.7	8.1	54.1
1953	2,190	705	503	202	1,485	23.0	9.2	67.8
		First permanent molars (ages 8-10)						
1946-47	712	131	63	68	581	8.8	9.6	81.6
1953	1,344	171	38	133	1,173	2.8	9.9	87.3
		Premolars (ages 12-14)						
1946-47	1,700	382	144	238	1,318	8.5	14.0	77.5
1953	1,692	266	59	207	1,426	3.5	12.2	84.3
		First permanent molars (ages 12-14)						
1946-47	696	355	240	115	341	34.5	16.5	49.0
1953	838	270	146	124	568	17.4	14.8	67.8

true for carious approximal surfaces (table 2 and fig. 2). Inasmuch as the changes in caries experience for children in this study as determined by direct observation alone were essentially the same as those for all the children in their age groups, it is likely that the rest of the first-, fourth-, and eighth-grade children would provide similar X-ray findings.

The reduction in caries between 1946-47 and 1953 was statistically significant, as can be seen by an inspection of the standard error terms (last column in tables 1 and 2). The reduction cannot be explained by differences in the age or sex distribution (table 3) or by variations in the number of teeth at risk (table 4) since these

were all essentially the same for the two periods. The between-method variation in the magnitude of the differences between the 1946-47 and 1953 caries rates might be attributed to chance.

The findings suggest, both numerically and proportionally, that there was little variation in the effectiveness of the clinical examinations between 1946-47 and 1953. The maximum X-ray increments for 12- to 14-year-old children were 3.60 DMF teeth per child in 1946-47 and 3.29 in 1953. If the mean number of teeth in eruption (table 4) is used as the denominator, X-rays revealed the first evidence of caries for 13 percent of the teeth in eruption in 1946-47

**Table 6. Approximal surfaces with dentinal caries, by individual and by combined roentgenographic readings, Grand Rapids, Mich., 1946-47 and 1953**

Criteria for acceptance of lesions	1946-47		1953		Change in caries experience: <sup>1</sup> Surfaces per 100 surfaces present
	Number of carious surfaces	Number of carious surfaces per 100 surfaces present	Number of carious surfaces	Number of carious surfaces per 100 surfaces present	
Deciduous molars (ages 5-7)					
Either reading.....	622	37.7	503	23.0	-14.7
Reading 1 only.....	595	36.1	479	21.8	-14.3
Reading 2 only.....	600	36.4	479	21.9	-14.5
Both readings.....	573	34.8	452	20.6	-14.2
First permanent molars (ages 8-10)					
Either reading.....	63	8.8	38	2.8	-6.0
Reading 1 only.....	56	7.9	34	2.5	-5.4
Reading 2 only.....	61	8.6	32	2.4	-6.2
Both readings.....	54	7.6	28	2.1	-5.5
Premolars (ages 12-14)					
Either reading.....	144	8.5	59	3.5	-5.0
Reading 1 only.....	125	7.4	49	2.9	-4.5
Reading 2 only.....	135	7.9	53	3.1	-3.8
Both readings.....	116	6.8	43	2.5	-4.3
First permanent molars (ages 12-14)					
Either reading.....	240	34.5	146	17.4	-17.1
Reading 1 only.....	227	32.6	136	16.2	-16.4
Reading 2 only.....	226	32.5	137	16.4	-16.1
Both readings.....	213	30.6	127	15.2	-15.4

<sup>1</sup> Minus indicates a decrease in 1953.

**Table 4. Mean number of teeth per child subject to the risk of caries, Grand Rapids, Mich., 1946-47 and 1953**

Type of teeth and age group	1946-47	1953
Deciduous molars: 5-7.....	7.63	7.77
Permanent teeth:		
8-10.....	14.03	13.76
12-14.....	26.80	26.56
Premolars: 12-14.....	7.60	7.48

others were examined. Of those who received X-ray examination in addition to the regular examination, 736 (312 in 1946 and 1947, and 424 in 1953) met the residence requirements. As there was no essential difference in the caries experience of the 167 radiographed in 1946 and the 145 in 1947, the data for these 2 years were combined.

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### Support for Clinical Findings

Supplementation of the dental examinations with bite-wing X-rays did not change the basic observation that decreases in dental caries occurred among the Grand Rapids children between 1946-47 and 1953. The mean numbers of carious teeth were smaller in 1953 than in 1947 whether estimated by direct observation alone or by direct observation plus X-ray examination (table 1 and fig. 1). The same was

**Table 5. Caries of approximal surfaces, by depth of lesion as determined by X-rays, Grand Rapids, Mich., 1946-47 and 1953**

Year(s)	Number of approximal surfaces present	Number of carious surfaces			Number of caries-free surfaces	Number of carious surfaces per 100 surfaces present		
		Total	Caries of dentin	Caries of enamel only		Caries of dentin	Caries of enamel only	Caries free
Deciduous molars (ages 5-7)								
1946-47.....	1,648	756	622	134	892	37.7	8.1	54.1
1953.....	2,190	705	503	202	1,485	23.0	9.2	67.8
First permanent molars (ages 8-10)								
1946-47.....	712	131	63	68	581	8.8	9.6	81.6
1953.....	1,344	171	38	133	1,173	2.8	9.9	87.3
Premolars (ages 12-14)								
1946-47.....	1,700	382	144	238	1,318	8.5	14.0	77.5
1953.....	1,692	266	59	207	1,426	3.5	12.2	84.3
First permanent molars (ages 12-14)								
1946-47.....	696	355	240	115	341	34.5	16.5	49.0
1953.....	838	270	146	124	568	17.4	14.8	67.8



true for carious approximal surfaces (table 2 and fig. 2). Inasmuch as the changes in caries experience for children in this study as determined by direct observation alone were essentially the same as those for all the children in their age groups, it is likely that the rest of the first-, fourth-, and eighth-grade children would provide similar X-ray findings.

The reduction in caries between 1946-47 and 1953 was statistically significant, as can be seen by an inspection of the standard error terms (last column in tables 1 and 2). The reduction cannot be explained by differences in the age or sex distribution (table 3) or by variations in the number of teeth at risk (table 4) since these

were all essentially the same for the two periods. The between-method variation in the magnitude of the differences between the 1946-47 and 1953 caries rates might be attributed to chance.

The findings suggest, both numerically and proportionally, that there was little variation in the effectiveness of the clinical examinations between 1946-47 and 1953. The maximum X-ray increments for 12- to 14-year-old children were 3.60 DMF teeth per child in 1946-47 and 3.29 in 1953. If the mean number of teeth in eruption (table 4) is used as the denominator, X-rays revealed the first evidence of caries for 13 percent of the teeth in eruption in 1946-47

Table 6. Approximal surfaces with dentinal caries, by individual and by combined roentgenographic readings, Grand Rapids, Mich., 1946-47 and 1953

Criteria for acceptance of lesions	1946-47		1953		Change in caries experience: <sup>1</sup> Surfaces per 100 surfaces present
	Number of carious surfaces	Number of carious surfaces per 100 surfaces present	Number of carious surfaces	Number of carious surfaces per 100 surfaces present	
	Deciduous molars (ages 5-7)				
Either reading-----	622	37.7	503	23.0	-14.7
Reading 1 only-----	595	36.1	479	21.8	-14.3
Reading 2 only-----	600	36.4	479	21.9	-14.5
Both readings-----	573	34.8	452	20.6	-14.2
	First permanent molars (ages 8-10)				
Either reading-----	63	8.8	38	2.8	-6.0
Reading 1 only-----	56	7.9	34	2.5	-5.4
Reading 2 only-----	61	8.6	32	2.4	-6.2
Both readings-----	54	7.6	28	2.1	-5.5
	Premolars (ages 12-14)				
Either reading-----	144	8.5	59	3.5	-5.0
Reading 1 only-----	125	7.4	49	2.9	-4.5
Reading 2 only-----	135	7.9	53	3.1	-3.8
Both readings-----	116	6.8	43	2.5	-4.3
	First permanent molars (ages 12-14)				
Either reading-----	240	34.5	146	17.1	-17.1
Reading 1 only-----	227	32.6	136	16.2	-16.4
Reading 2 only-----	226	32.5	137	16.4	-16.1
Both readings-----	213	30.6	127	15.2	-15.4

<sup>1</sup> Minus indicates a decrease in 1953.

and for 12 percent in 1953. Selection of the denominator for these and other proportions is based on Hill's advice concerning numerators, denominators, and proper use of the risk factor (19).

### New Information From X-Rays

The X-ray data revealed that most of the decrease in caries of the approximal surfaces occurred among the deeper lesions (those involving dentin) and that there was little or no change in the number of shallow lesions (those limited to the enamel). These findings are shown in table 5, where depth of lesion as de-

termined by X-ray is related to the number of approximal surfaces present. The denominators are the numbers of surfaces at risk; they are thus corrected for the slight variation in the number of teeth in eruption but not for any possible variation in time of eruption. Extracted teeth were excluded since there was no way of determining the caries experience of their approximal surfaces.

The difference between the 1946-47 and 1953 caries patterns with regard to depth of lesion is consistent with the hypothesis that fluoride retards the development of dental caries. A reasonable explanation for the data is that some enamel lesions did not progress to dentinal

Table 7. Approximal surfaces with caries limited to the enamel, by individual and by combined roentgenographic readings, Grand Rapids, Mich., 1946-47 and 1953

Criteria for acceptance of lesions	1946-47		1953		Change in caries experience: <sup>1</sup> Surfaces per 100 surfaces present
	Number of carious surfaces	Number of carious surfaces per 100 surfaces present	Number of carious surfaces	Number of carious surfaces per 100 surfaces present	
Deciduous molars (ages 5-7)					
Either reading.....	134	8.1	202	9.2	+1.1
Reading 1 only.....	116	7.0	181	8.3	+1.3
Reading 2 only.....	125	7.6	200	9.1	+1.5
Both readings.....	106	6.4	178	8.1	+1.7
First permanent molars (ages 8-10)					
Either reading.....	68	9.6	133	9.9	+0.3
Reading 1 only.....	66	9.3	125	9.3	0
Reading 2 only.....	63	8.8	118	8.8	0
Both readings.....	61	8.6	110	8.2	-.4
Premolars (ages 12-14)					
Either reading.....	238	14.0	207	12.2	-1.8
Reading 1 only.....	231	13.6	184	10.9	-2.7
Reading 2 only.....	201	12.0	196	11.6	-.4
Both readings.....	198	11.6	173	10.2	-1.4
First permanent molars (ages 12-14)					
Either reading.....	115	16.5	124	14.8	-1.7
Reading 1 only.....	115	16.5	114	13.6	-2.9
Reading 2 only.....	101	14.5	118	14.1	-.4
Both readings.....	101	14.5	108	12.9	-1.6

<sup>1</sup> Minus indicates a decrease in 1953; plus, an increase.

lesions and that many enamel lesions did not occur or at least did not develop to a size detectable by practical methods. (Some enamel lesions might have been replaced by microscopic lesions of the type described by Burket (20); this study did not investigate these lesions). The nonappearance of the shallow lesions is also consistent with the hypothesis that fluoride actually prevents the inception of caries. The alternative hypothesis that fluoride selectively prevents caries of the dentin is not supported by these data, as this hypothesis would require decreases in dentinal caries to be balanced by increases in enamel caries.

### Effect on DMF Studies

Bite-wing roentgenography produced less change in estimates of caries experience of teeth (DMF or def) than that of approximal surfaces (DF or df). This can be seen by comparing parallel radiographic increments of these scores in figures 1 and 2. The lower sensitivity of DMF estimates is related to the high susceptibility of children's teeth to occlusal caries (21), the relative ease of detecting occlusal lesions by direct observation (2), and the fact that a tooth is counted only once in arriving at a DMF score. Only radiographic evidence of caries in a tooth deemed to be free of caries on direct observation would add to a DMF score.

The methods selected for combining the direct observation and roentgenographic data did, in fact, present the direct observation findings adversely, as can be seen in figures 1 and 2. As shown in tables 6 and 7, different methods of using the two independent X-ray readings would have led to the same conclusions: that there was a substantial decrease in dental caries experience and that this decrease occurred primarily among the deeper lesions. The essential conclusion—that there was a substantial decrease in dental caries experience—was reached without the X-rays.

### Summary

Bite-wing roentgenography was used to supplement the regular dental examinations of 736 continuous resident children of Grand Rapids,

Mich., in 1946-47 and 1953. Findings from direct observation indicated that the children in the X-ray sample were representative of their age peers in the entire sample of children examined in those years.

The roentgenograms were read for radiolucencies of dentin and for discontinuities of the enamel surface. For the primary purpose of testing the effect of X-ray findings on conclusions reached by direct observation alone, the X-rays were read twice and any surface scored as carious at either reading was added to the directly observed estimate of caries.

There were wide but consistent variations in total caries experience according to the three methods of estimation, but all estimates demonstrated a significant decrease in total caries experience between 1946-47 and 1953. The decrease in caries appeared to be greater for deeper lesions than for shallow lesions. This was demonstrated by analysis of roentgenographic data without reference to the regular dental examinations and was independent of the method used to combine the two X-ray readings. The decrease in the deeper lesions without a balancing increase in the shallow lesions suggests that fluoride retards the development of caries and that it also prevents the inception of caries.

From this study, we draw the following conclusions:

1. Roentgenographic findings support the clinical finding that fluoridation of a municipal water supply is an effective caries control measure.
2. Estimates of dental caries experience expressed as the number of decayed, missing, or filled teeth are less sensitive to modification by roentgenographic findings than are estimates of caries expressed as the number of decayed or filled approximal surfaces.

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## CONFERENCE REPORT

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In the light of the needs for health services in the border region of the southwest, organized health officials there have recommended that official agencies underwrite a survey and evaluation of conditions as a guide to future action. At the same time, they have undertaken in an exemplary manner to help each other in dealing with responsibilities which respect no jurisdictional barriers. The following information, based on papers presented at the 14th annual meeting of the United States-Mexico Border Public Health Association, indicates both the challenges and achievements in this territory. The meeting was held April 13-16, 1956, jointly in California and Baja California in the border cities of Calexico and Mexicali.

# MUTUAL AID

THE INTERNATIONAL BOUNDARY area between the United States and Mexico is unique, for here we have two cultures, representing striking contrasts in language, socioeconomic conditions, and technological development, confronting one another across a practically unguarded and, for the most part, sparsely settled border more than 2,000 miles in extent.

In order to foster understanding of public health needs and through mutual assistance to promote public and personal health along the United States-Mexico border, the United States-Mexico Border Public Health Association was organized in 1912 with the encouragement and assistance of the Pan American Sanitary Bureau. This official international health organization has continuously furnished our association with an executive secretary, who is also chief of the El Paso (Tex.) field office of the bureau.

During the past year two major accomplishments of the association were the bi-State meeting of California and Baja California, Mexico, and the Special Study Committee Conference recommendations on a proposed border evaluation study of health conditions and resources.

At the bi-State meeting of California and Baja California, more than 100 persons from local, State, and Federal health agencies, as well as social welfare and voluntary health agencies, participated in the deliberations.

This was the first bi-State meeting sponsored by our association.

The need for potable and adequate water supplies, safe sewage disposal, careful control and management of food supplies, safety factors in housing and employment, and in air pollution received special attention.

The lack of adequate sanitary facilities for

field workers in agriculture and the great need for careful study of working and living conditions of the migrant agricultural laborer and his family were emphasized.

The language barrier was mentioned as one of the problems of the maternal and child health program. It was suggested that incentive pay for bilingual health workers might help solve this difficulty.

An intensive program of investigation, education, and publicity was advocated in tuberculosis and venereal disease control.

The special study committee recommendations on a proposed border evaluation study of health conditions and resources were developed after much correspondence.

These recommendations have been submitted to the respective Federal departments of health and the Pan American Sanitary Bureau.

Other activities of interest to and stimulated by the association, either directly or indirectly, included the following:

Interchange of ideas and opinions regarding a border field training program and the possible establishment of a permanent field training center.

Tijuana, Baja California, and San Diego, Calif., both contributed to the cost of chlorination of the sewage effluent emptying into the Tijuana River as negotiations and discussions continue for a permanent solution of this pollution problem.

Meetings between Mexicali and Imperial County health officials were held with discussions referring to diarrhea, venereal disease, and the education and training of personnel.

Along the Arizona-Sonora border, in the area of Nogales, Naco, Agua Prieta, Bisbee, and Douglas, working relationships were established between the local health officials to control venereal disease.

El Paso, Tex., and Juarez, Chihuahua, joined in a mosquito survey in the two municipalities.

Personnel from Laredo, Tex., collaborated with the health officials of Nuevo Laredo, Tamaulipas, in carrying out a sanitation survey of that neighboring city.

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*From the address of George W. Marx, C.E., M.P.H., president of the association and director and chief engineer, bureau of sanitation and sanitary engineering, Arizona State Department of Health.*

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# BORDER HEALTH CONDITIONS

The multiple complexities peculiar to public health services in semiarid lands, reviewed in the president's address, were dealt with separately by other speakers whose remarks here are grouped roughly in categories concerned especially with sewage disposal; the zoonoses; general sanitation, with special reference to the needs of migrant labor; health education; rehabilitation; and communicable diseases, in that order.

Sewage disposal presents unusual complexities in the southwest border region. Water for carriage and dilution usually is limited by an arid climate. Water used for sewage is used also in many places for irrigation. The irrigation ditches in dry seasons and the fields themselves, when they are occupied by armies of field hands, are fecal depositories. Contamination of the fields poses a possible threat to the

consumer of raw vegetables harvested there and increases the incidence of beef tapeworm, an expense to the cattle grower and a hazard to the health of consumers of raw or slightly cooked, uninspected beef.

Contamination by body wastes is a factor that enters also into the comments on the management of housing, both for permanent and transient residents; education to reduce infant mortality; and certain communicable diseases. Another pervasive theme in these comments, most evident with respect to health education and community organization, is the way difference in language and tradition affects health practices and attitudes. The last papers summarized below deal with microbial infections, which in many parts of the United States have ceased to be of major concern but which still persist as threats to the people of the border.

## Irrigation With Sewage Impractical for Safety

The question of the use of sewage for irrigation was analyzed thoroughly by G. R. Herzik, Jr., chief engineer of the Texas State Health Department, represented by Frank J. Von Zuben, chief of general sanitation. Referring to the Willem Rudolfs (Rutgers) study, commissioned by the United States Army Quartermaster, he acknowledged that under careful control lands irrigated with sewage can produce vegetables acceptable for human consumption, but he held that such controls pose operating obstacles that "in practice are virtually insurmountable."

Beyond all controls on the farm, the Rutgers study concluded that "the only reliably effective method for decontamination, with respect to bacterial as well as helminthic organisms, is . . . pasteurization at 60° C. Not only are all the undesirable organisms killed, but the quality of the vegetable is not in-

jured," he said. But this precaution, too, seemed impractical for the homemaker. In June 1952, the Texas Board of Health prohibited sewage for irrigating food crops which might be consumed in the raw state.

Herzik spoke in favor of using treated sewage on fields used for animal feed or pasture or in connection with soil conservation work provided stream pollution is avoided. He does not believe wet or air-dried sewage sludge should be used to fertilize crops intended for human consumption.

## Clean Water In Mexico

Against this background, P. J. Caballero, sanitary engineer, Office of Hydraulic Resources, Mexico, reviewed sewage disposal facilities in the Mexican watershed of the Rio Grande. Two international plants are in operation, and others are in construction. Most of the Mexican cities have sewers. No plants in the

watershed have treatment facilities, but their sewage is impounded before it reaches the Rio Grande. Lands irrigated with sewage are for the most part used to grow cotton, he said.

The most acute condition is created outside the Rio Grande Valley at Tijuana, Baja California. The Tijuana River carries sewage from that city through United States territory and contaminates California beaches.

At Mexicali, Baja California, and Calexico, Calif., treatment facilities in construction include 62 acres of oxidation lagoons with the possibility that the effluent may be used for irrigation or for washing salted land.

## Tapeworm Hazard In Dry Lands

The animal stake in sewage disposal was described by Donald Miller, D.V.M., veterinarian in charge, Animal Disease Eradication and Animal Inspection and Quarant-

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The lack of adequate sanitary facilities for

field workers in agriculture and the great need for careful study of working and living conditions of the migrant agricultural laborer and his family were emphasized.

The language barrier was mentioned as one of the problems of the maternal and child health program. It was suggested that incentive pay for bilingual health workers might help solve this difficulty.

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*From the address of George W. Marx, C.E., M.P.H., president of the association and director and chief engineer, bureau of sanitation and sanitary engineering, Arizona State Department of Health.*

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Monterey County Health Department.

Many harvest workers, formerly stationed at sheds where they culled, packed, and iced vegetables trucked in bulk from the fields, now do their work with the use of cardboard containers and vacuum cooling at the picking site. This increase in the numbers of field workers has multiplied the need for toilets and lavatories, drinking water, and protection from excessive dust in the harvesting of fruit and vegetable crops.

After a survey of the needs, county health officials, under instructions from the State, proceeded to develop a pilot program of corrective measures, with the full cooperation of the Growers-Shippers Vegetable Association. The device most favored, after consideration of alternatives, was a mobile chemical toilet, with running water, a wash basin, paper towels, and soap, provided by the shipper for each harvesting crew. The units are housed in light steel, with an open metal floor, mounted on wheels for towing. A 50-gallon tank of water is fabricated into the top or back of the unit to supply the hand-washing basin. Drinking water will be supplied with paper cups or with portable fountains. The units will be inspected regularly. The next step is to appraise their value in use.

## Border Population Moves and Grows

A general appraisal of sanitation needs in Mexico's border territory, by Joaquin Segura, sanitary engineer, Mexican Public Health Service, emphasized population growth, with a movement to urban centers. In recent years, several border cities have grown from a few hundred souls to tens of thousands. Progress in sanitation has been accompanied by a rapid decline in infant mortality in the border cities: from 266.4 per 1,000 in 1901 to 95.8 in 1950, with still some distance to go.

The health needs of the transient agricultural worker, or those who move to settle in rural areas north of the border, are complicated by a

strange environment, language difficulties, temporary housing, frequent change of locale, and by weather, altitude, and temperature conditions unfamiliar to the migrant. Such families also may be susceptible to pathogens which they encounter for the first time in a new environment.

## Slum Clearance Project In Mexicali Area

A specific example of the management of a slum area in Mexicali, Baja California, was described by Enrique Ramirez del Toro, engineer in the Coordinated Health Services in the State of Baja California. As Mexicali achieved new growth, more than 10,000 people lived in the "New River" neighborhood, below sea level, subject to periodic floods, both from rains and sewers.

A flood in January 1953 brought the threat of an epidemic, which was met by the decision to evacuate the area. Families were quartered in private buildings and in schools, with food, clothing, and medicines provided by the government.

Health officials directed installation of cesspools, removal of domestic animals, installation of portable baths, immunization, and spraying of occupied buildings.

To provide permanent quarters for the families, the government awarded to each of 2,769 housewives a lot of 150 square meters in a neighborhood with a central park, planted with grass and flowers. Safety lanes are provided for pedestrians, and three zones are reserved for schools. The government also erected sample houses to stimulate private capital to invest in low-cost expandable homes, with hygienic facilities.

The former slum is now the site of the city's main sewer, known as the "Great Collector."

## Cross-Border Projects Coast to Coast

Such joint concerns as the health of migrant families are the basis of cross-border health projects re-

viewed by Dr. David M. Cowgill, director of the Cameron and Hidalgo County Health Units, San Benito, Tex. These enterprises are in progress all along the border from the coast of California to the mouth of the Rio Grande. Specifically described were those of San Diego-Tijuana, Imperial County-Mexicali; El Paso-Juarez; Eagle Pass-Piedras Negras; Laredo-Nueva Laredo; and Cameron County-Matamoros area. Conspicuous among the joint projects were programs of sanitation, health education, vector control, water pollution control, prevention of venereal disease, and tuberculosis surveillance and treatment.

## Farm Placement Prevents Infection

Health conditions of Mexican migrant workers were discussed in a review of the medical aspects of the farm placement program in charge of Dr. Harold D. Lyman, medical director, Public Health Service, El Paso, Tex.

There are four migratory stations south of the border. Migrants are examined at these stations by Mexican physicians and are vaccinated against smallpox by Mexican nurses. The examination selects those who are fit for hard labor and free from contagious or mental disease. Transportation is supplied to the five reception centers on the border, namely, El Centro, Calif.; Nogales, Ariz.; and El Paso, Eagle Pass, and Hidalgo, Tex.

The reception centers apply disinfection, screen and treat venereal disease, and take a 70-mm. chest X-ray of each migrant. Medical care, including hospitalization if necessary, is also provided. Since inception of the program in 1951, authorized by Public Law 78, 82d Cong., the total number processed has increased from 124,000 to more than 400,000 a year. A peak of 500,000 Mexican farm workers is anticipated for 1956.

About 3 percent of the applicants were rejected in 1955 at migratory stations and half as many more at the reception centers. The X-ray

tine Branches, Agricultural Research Service, United States Department of Agriculture. Changes in farming and irrigation practice, he said, have multiplied the possibilities of exposure of livestock to the larval form (*Cysticercus bovis*) of the beef tapeworm (*Taenia saginata*). To determine the prevalence of the parasite in humans, especially ranch and farm laborers, he recommended laboratory examination of stool specimens, as clinical symptoms of tapeworm often are vague. He specified microscope examination of three daily stool specimens, run through a sieve and centrifuged or floated with a concentrated salt solution.

Exposure of the American public may be judged by the following facts: About 65 percent of the beef consumed in the United States is examined by inspectors of the Federal Meat Inspection Service. The records indicate that, in 1912, of the cattle inspected 0.14 percent were infested with *C. bovis*. In 1930, the percentage was up to 0.37. In 1945, it was 0.6. From 1951 through 1955, the nationwide occurrence of *C. bovis*, as indicated by the number of carcasses ordered to be retained for treatment by freezing, was at a rate that declined from 0.1-12 to 0.073. In Arizona, the rate has declined from 4.5 in 1945 to about 0.5 in recent years.

Such percentages are little consolation to the cattle owner who may encounter an outbreak in a cattle feed lot. Such an outbreak may result from careless disposal of the feces of a single carrier. And if the cattle do not undergo inspection at time of slaughter, the hazard may be transmitted to eaters of raw or lightly cooked meat.

In 1955, inspectors at a slaughterhouse found more than two-fifths of a single herd of 1,980 cattle, pastured and pen fed in Arizona, were infested, 16 so heavily that they had to be condemned. The other infested cattle were held for freezing, at a substantial loss to the rancher.

*C. bovis* in beef cattle has been associated with fecal fields used subsequently for pasture; with irrigation of pastures by primary sewage effluent; with ground feed from

freight cars contaminated by transient laborers; and with direct contamination of irrigation ditches by ranch workers.

South African studies indicate that pastures may remain infective for as long as 2 years after deposition of *C. bovis*. Other studies, however, have found infections without indication of a probable source.

Research in the field now seeks to determine accurately the age of *C. bovis* cysts found in bovine muscle; how soon such cysts may be found after ingestion of viable eggs; at what age such cysts are infectious; and, if possible, methods to improve control of the parasite.

A critical but relatively simple step in such control, Miller concluded, is the diagnosis and treatment of human carriers of *T. saginata* by physicians and public health agencies, especially in the neighborhood of pastures or feed lots. Another basic step is comprehensive inspection of meat slaughtered for market. In addition to providing privies, latrines, or other suitable facilities for hired hands, Miller emphasized, cattlemen should refrain from employing raw sewage for irrigation of pastures and should support programs to develop sanitary habits by education.

## Brucellosis Control Gains With Vaccine

Veterinary services to public health in southern California were outlined by J. E. Stuart, chief, division of animal husbandry, California State Department of Agriculture.

Since 1940, all counties in the State have been classified as having less than 0.5 percent tuberculosi. Total herds which number more than 50,000, with a total of more than 3,500,000 head, have been tested. Actual tests show that reactors in recent years have amounted to less than 0.2 percent. About 650,000 cattle in 17,000 herds are tested annually by veterinarians employed in the agriculture departments of California and the Federal Government.

California's program for brucel-

losi control consists of requiring vaccination of female dairy calves. Vaccination of other calves is offered but not required. Since this program began, in 1948, more than 2,400,000 calves have been vaccinated, one-third on a voluntary basis. The aim is eventually to have herds consist wholly of vaccinated animals. About 9 of every 10 head in the State now have been vaccinated.

Infection in State dairy cattle has been reduced in 8 years from 18 percent to less than 5 percent. More than half of the herds are completely negative, on the basis of a milk ring test conducted last year with a mobile laboratory. The national goal is a rate of infection of less than 1 percent, with infection present in less than 5 percent of the herds.

Movement of dairy cattle, except for slaughter, is forbidden by the State unless the cattle test negative or have been vaccinated. The State furnishes desiccated strain 19 for vaccination without cost, and pays accredited veterinarians for doing the vaccinating.

A voluntary brucellosis program is applied to swine.

Following the 1952 outbreak of vesicular exanthema, as a preventive measure, a cooking program was inaugurated and since November 1955 all garbage fed to hogs has been cooked. Incidental effects of this program, which includes other sanitation measures, has been to reduce the hazard of trichinosis, reduce fly breeding, and reduce rat breeding. Outbreaks of vesicular exanthema have been reduced from 49 in 1954 to 15 in 1955. It is believed the cycle of this disease has been broken in California.

Other zoonoses commented upon by Stuart included anthrax, ornithosis, salmonellosis in turkey flocks, tapeworm, and rabies.

## Lettuce Pickers Try Sanitation on Wheels

Opportunities for improving sanitation among harvest workers were described by Edward W. Munson, director of sanitation in California's

spread of the epidemic by personal contact. Children played freely in the garbage storage and overburdened toilet and shower rooms.

In the laundry rooms, the rinsing of soiled diapers proceeded while children were being washed, sometimes in the same tub. The 27 toilets were used by more than 400 individuals of whom more than 160 were not yet 10 years old. Many trailer residents also used chambers and charged their children with the duty of disposing of the contents, a duty they performed somewhat whimsically. Often the children emptied chambers into laundry tubs and neglected to flush them. Children rarely washed their hands after emptying the chambers.

Those infected by *Shigella* could not be isolated. The abundance of flies and the lack of screening also encouraged propagation of the infection.

The report concluded that trailer court operators should be helped to overcome conditions which tend to make the villages an incubator of infectious, that legislation enacted by the State would help to strengthen health department authority with respect to housing in trailer camps, and that all public health services should be applied to help residents of trailer villages shoulder their responsibilities.

After the report was written, other outbreaks of a similar nature were reported in other trailer courts within the county jurisdiction. These outbreaks also occurred in trailer courts having a large number of children with consequent overcrowding and misuse of the community toilet and laundry facilities.

## Nurse Recommends Democratic Tactics

To illustrate practical techniques in an educational campaign for implementing community health programs, Hazel Shortal, public health nursing consultant, Region 9, San Francisco, described hypothetical situations.

"Successful and sustained efforts to reduce the maternal and infant

deaths," she said, "would depend on improving the care of mother and child through adequate food, education, and medical and nursing care during pregnancy and infancy.

"Let us develop two widely different plans. In the one instance, let us say that it is decided that quick action is necessary and therefore a team of experts will be sent to the community, responsible for the organizing, directing, and operating on a demonstration basis a program of improved care for mothers and children. The team will bring the materials, supplies, and moneys. Thus equipped, changes can readily be accomplished, and success assured. Meetings will be called for the purpose of informing the people of the services that have been brought to them. Local people will be expected to respond to this generous effort of the government, and soon the experts will observe gratifying results.

"In the other instance, representatives from the Ministry of Health sent to the community will seek out the leaders in the various local groupings. The facts of maternal and infant mortality in the community will be discussed. Efforts will be made to gain the understanding of these leaders in regard to the problem, and to give the Ministry representatives something of local attitudes and behavioral patterns. Plans will be developed only after the local leaders accept their role in arriving at a solution of the problem. A service for mothers and babies will be established when the community decides that this is desirable. The Ministry will supply medical and nursing participation in the service upon request of the community. Local leaders announce the plan.

"Approval of the project by the local padre is signified by his offering physical facilities for holding clinics. Midwives will participate in the clinics by offering assistance to patients in preparing for the physical examination. The *curandero* will interpret reactions and attitudes to the physician, and, in turn, the medical recommendations to the patients. The physician and nurse will spend time with all concerned after the clinic sessions answering ques-

tions and increasing their knowledge of cultural settings in the community.

"When the problem of a more adequate diet is realized, this community itself will make the determination that help is needed and ways will be explored for effective implementation of a farm improvement program. When the community sees opportunities for initiating health practices through the schools and perceives the value of the educated person as a contributor to improved living in the community, adequate support of school programs can be expected.

"In both settings the stated objective may be reached; that is, reduction of infant and maternal deaths.

"The first situation may even eventually be taken over with local community sponsorship, but the planning described cannot be said to stimulate local interest, and the likelihood of the program surviving the stay of the team experts is not great. In the second instance, in which each step in the development of the program was a local decision and supported by responsible local leaders, only technical guidance was needed from the Ministry representatives. Pride in development and responsibility for action rested with the local groups. Satisfaction in a job well done will be sensed by the local people as well as the representatives of the Ministry."

## Handicapped Children Need Coordinated Services

In an effort to guide growing communities in the development of services for children, Dr. Marcia Hays, chief of the bureau of crippled children's services in the California State Department of Health, reviewed early American practice as she outlined requisites for initiating coordinated services locally. She told how Americans first attempted to aid handicapped children by bringing them to medical centers, where they received the most expert medical attention the department could provide.

"Often because of the chronicity of the disability or infection, the incon-

screening resulted in rejection of 1.1 percent of the applicants. More than half of these are in the minimal stage of tuberculosis, a few far advanced.

## Reception Centers Screen Migrants

Dr. Victor Ocampo Alouzo of Mexicali, health officer for Baja California, reviewed operations of the agreement between the United States and Mexico at reception centers. He pointed out that workers rejected for reasons of health put an unanticipated burden on the cities where they are sent for repatriation. He observed also that the arrival of large numbers at the reception centers creates health hazards when there is a lack of facilities and organization to provide for them.

While he acknowledged that many workers rejected at the placement centers should have been stopped at the Mexican migratory center, he observed also that many migratory workers, found fit at the migratory center, are likely to suffer en route from lack of sanitation or lack of consideration given to the transportation of workers by railroad or highway. He spoke of movement of workers without toilet facilities or drinking water. For lack of nourishment, he said, many arrived in a starving condition, easy prey to acute communicable disease, exposed to sunstroke in summer and to freezing in winter.

Management of migration has improved, however, to the extent that the number of wetbacks or wire-jumpers has declined from 565,000 in 1951 to 20,000 in 1955.

## Investigation of Diarrhea In a Migrant Labor Camp

A report of an epidemiological investigation of shigellosis in an Arizona migrant farm labor camp in which *Shigella* was recovered from flies and feces deposited on the ground was offered by Paul J. Coleman, M.D., epidemiologist, and Paul P. Maier, M.P.H., sanitary engineer, of the Phoenix (Ariz.) Field Station,

Communicable Disease Center, Public Health Service.

During the period November 15-30, 1955, 13 individuals from 3 households in a camp of approximately 100 inhabitants were hospitalized. Since all 3 families gave histories of illness prior to arriving at the camp, opportunity for intrafamilial spread existed. *Shigella* was isolated from 8 of the patients and, during the normal population survey of the workers, from the operator of a chuck wagon who served workers in the field. *Shigella* was isolated from 7 of 37 fly pools (18 percent) and from 9 of 30 (25 percent) of cultures obtained from fresh deposits of human feces on the ground.

All organisms typed were *Shigella flexneri* 3, which was the only pathogenic organism isolated during the investigation. The history of one affected family suggests that the original infection may have been carried from Seattle, Wash., to Arizona. Environmental conditions in the camp were conducive to the high fly population, and these vectors probably contributed substantially to the mild cases and subclinical infections reported from other inhabitants of the camp.

## Curb Diarrheal Deaths In Texas Infants

In 1948, it was noted that six counties in Texas contributed less than one-fifth of the live births but almost half of the deaths from infant diarrhea.

Ruby M. Lee, R.N., M.A., public health nursing consultant, Texas State Health Department, said Texas has reduced infant mortality because it expanded educational activities of organized health services, increased sanitation work, and established additional well-child conferences and nursing services with the assistance of many public and voluntary agencies.

Among specific measures employed, a public health nurse visited each home where a midwife delivery was reported on a birth certificate. These visits directly increased attendance at well-child conferences, and severe diarrhea incidence in

infants subsequently declined. The counties which formerly contributed half of the deaths from infant diarrhea now contribute a fourth.

Further reduction, Lee reported, would depend on early case finding, prompt diagnosis, early initiation of medical and nursing care, and education.

(In one of these counties, experimental fly control programs conducted by the Public Health Service contributed to reducing the mortality from infant diarrhea for the period under study.)

Lee reported that the number of pit privies in one city was reduced from 2,500 to 15, by a concerted drive, but that a new annex subsequently increased the number to 600.

## Shigella Finds Ideal Environment

That Mexican migrants are not the only members of the mobile population in need of protection and health education was the implication of a report by Don Suggs, public health engineer, Los Angeles County Health Department, on an epidemic of shigellosis in a trailer village. Among residents of this village, at the time of a survey, craftsmen were predominant, followed by service workers, professional and white collar workers, and the semiskilled. Only three were classed as laborers and one resident was from the United States Army.

More than a third of the residents had been there less than 2 months, but nearly a fifth had been in residence a year or more, a few for more than 5 years.

Despite intensive efforts of the health department, two separate *Shigella* epidemics occurred in the trailer village within a period of 8 months.

Food and water supplies were free from contamination at the point of delivery. Running water was supplied each kitchen sink. Water flush toilets and sewer-connected laundry facilities were available in two community buildings. Very few of the trailers had individual toilets.

Nevertheless, the premises, heavily populated with children, favored

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serving prophylactic instructions even if they are so inclined.

Dr. B. Aranda Reyes described services of the phthisiology department of the Federal Department of Public Works hospital in Mexicali Valley, Baja California, which, he said, had the highest tuberculosis mortality in the country, 12.6 deaths per 10,000 inhabitants. Screening and hospitalization services are limited by the fact that patients cannot afford the expense of a trip to the center and by the shortage of available beds.

## Where Aegypti Persists, Yellowjack Threatens

Dr. J. Austin Kerr, special expert in yellow fever and related virus diseases, Pan American Sanitary Bureau, Washington, D. C., reviewed events stemming from the epidemic of yellow fever which began in 1948 in Central America. Yellow fever

had been limited to the jungle there, because *Aedes aegypti*, the urban carrier of the virus, had been eliminated from the towns.

However, as the infection moves north through the jungle, leaving a trail of dead monkeys, it is expected to enter the Mexican states of Chiapas, Tabasco, and Veracruz, where *A. aegypti* may pick it up.

The presence of this mosquito species in large areas of the United States and Mexico, he reminded his audience, may trigger an explosive epidemic of yellow fever. Although the last fatality from this disease in either country was recorded in 1924, Kerr pointed out that, thanks to rapid modern transportation, a person with the disease still in incubation may arrive in Houston, New Orleans, Progreso, or Merida any time. If *aegypti* mosquitoes find the patient before the health department does, infection, panic, and disorganization of the community may be expected, all for the lack of species eradication.

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venience of transportation, and the lack of services in the home community, a child remained in the center 1, 2, or 3 years. The family reorganized its life without their child, and the child grew without a family. And then abruptly when we felt our work was done, the child was discharged and returned to what had been his home. But this was not the same child to his family, and they were not the same family to the child, and what we called 'the adjustment' was slow, painful, and confusing to both the child and the family. Sometimes it would not be made, and so, as in more than one instance, we found the child later in the State school for delinquents. So our first approach, based on a well meaning desire to place fine medical care above everything else, was modified.

"Now in the development of services we are guided by a principle which has become as important as fine medical care: We say that the child is first a child in his family and he belongs at home. Where it is not possible to plan his care so that he may be at home, we bring parents and child together as often as possible, and we limit the time away from home so that separation cannot be established . . .

"Children need coordinated services in the home community, or reasonably nearby. To initiate them, neither definitive specialization nor the ultimate in buildings and equipment is a necessity. Good core services, built around perhaps a graduate physician and a qualified teacher—each with an understanding of parents and children, their needs and pattern of growth—should be the first step. And once these are established, attracting other disciplines and specialized skills to the community becomes a matter of proper timing."

## Sociologist Discusses Cultural Factors

Lyle Saunders, associate professor of preventive medicine and public health at the University of Colorado School of Medicine, called

attention to cultural factors that complicate the work of health agencies in border agricultural areas. Differences in social origin and cultural conditioning between professional and technical personnel and members of the public they serve hamper communication and make difficult the coming to agreement on health goals and the means for reaching them.

Cooperation across an international border, Saunders suggested, is further complicated by differing administrative philosophies, political traditions, governmental systems, and by a disparity in economic resources. He urged that public health agencies seek the collaboration of social scientists on programs where cultural or subcultural differences may be hindering factors.

## Penicillin Prevents

### *Neisseria gonorrhoeae*

The question of resistance of *Neisseria gonorrhoeae* to penicillin has been raised by physicians who have found positive smears taken from prostitutes who have received weekly doses of the antibiotic.

Dr. Mariano Curiel Alcain, chief of the venereal disease control program in Mexicali, Baja California, noted that injection of 300,000 international units of aluminum monostearate penicillin assures blood levels of the drug effective against *N. gonorrhoeae* for 96 hours. As the incubation period is generally 72 hours, weekly injections of that dose are assumed to be effective in preventing the disease.

Brailio R. Ramirez of the Institute of Hygiene, Mexicali, reported use of a medium of agar and cactus gum to culture 100 samples of cervical secretions from prostitutes under prophylactic control. Smears were taken from the colonies. Each of the subjects had taken 300,000 international units of aluminum monostearate penicillin weekly for at least 3 weeks before the test.

All but one culture were negative. The smear taken from the one positive culture was negative. He concluded that *N. gonorrhoeae* is not

resistant to penicillin as applied by the department to prostitutes for months or even years.

## Poliomyelitis Surveillance Pursued in Mexico

A report of a 1955 outbreak of poliomyelitis in Mexicali, Baja California, by Dr. Jose Reyes Ruiz, epidemiologist, Baja California State Health Department, stated that all of 24 cases reported occurred within the first 3 years of life. This evidence coincided with findings of an extensive epidemiological survey by Dr. Carlos Calderon and others in the Federal Department of Health in Mexico, who stated that from 1945 to 1954, 93 percent of the poliomyelitis patients identified were less than 5 years of age.

Calderon's report found a higher incidence of paralytic cases in families of very low income than in families of acceptable or good monthly income, 1.75 against 1.1 per 1,000 families. Differences in family sizes were not reported. The finding, contrary to experience in other countries, is attributed to crowding, on the ground that the infection is assumed to be a consequence of person-to-person contact.

## Eight-Year Campaign To Wipe Out Malaria

On the premise that limited DDT applications may encourage the rise of resistant malaria vectors, Mexico has launched a drive which is intended to eradicate malaria in 8 years and to maintain a surveillance system to prevent reinfection of carriers.

Dr. Manuel E. Pesqueira, Sub-Secretary of Health of Mexico, stated that, at present, malaria is found in three-fourths of Mexican territory, with 16 million inhabitants. Malaria parasites, third cause of death in the nation, produce fevers in about 2 million patients, with a mortality of more than 1 percent. The disease is most common in the Tehuantepec Isthmus.

The drive is in charge of the National Commission for the Eradication of Malaria, presided over by the Secretary of Health and Welfare. Technical assistance is provided by the World Health Organization, and the United Nations Children's Fund will contribute insecticides and equipment. The main financial contribution, 150 million pesos for personnel, comes from the Government of Mexico.

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*Under "on site" conditions, direct inoculation into cold untempered media of contaminated samples of sea water, followed by incubation 5 to 6 hours later, is a satisfactory technique for routine bacterial analyses.*

## Evaluating Bacterial Contamination in Sea Water Samples

By GERALD T. ORLOB, M.S. in C.E.

IT IS APPARENT that interpretation of the significance of bacterial analyses obtained during surveys of sewage pollution of sea water must be tempered with the realization that many factors influence their reliability. Not the least of these factors is the effect of bacterial die-away or regrowth during the period between sample collection and laboratory analysis.

Standard procedures for the bacteriological analysis of water samples usually recommend that inoculation be carried out as soon after collection as practical and that if storage is necessary the temperature should be kept between the limits of 0° C. and 10° C. Unfortu-

nately, because many sites under survey are remote from adequate laboratory facilities, storage during transportation becomes essential. Needless to say, refrigeration, though desirable, is not always convenient or practical. In the routine practice of public health and pollution control agencies charged with the bacteriological analysis of contaminated waters, delays of 5 to 6 hours are not uncommon. Often storage of samples overnight may be necessary (even though not the preferred procedure) in some overworked laboratories.

Delays or failure to provide refrigeration may significantly influence the results of individual analyses and, consequently, invalidate certain conclusions which might be drawn from the aggregate of results from a certain water under survey. If the water being investigated is that of an ocean bathing beach, the results of analysis may be close to worthless.

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*Mr. Orlob, assistant professor of civil engineering at the University of California, performed the investigative work represented by this paper during the 3½ years he was in charge of water pollution and industrial waste surveys for the State of Washington Pollution Control Commission. Author of 14 reports and papers covering these investigations and of additional research reports associated with water reclamation, he is engaged at present in a fundamental study of the factors influencing the movement of bacteria in underground water. The project is sponsored by the Public Health Service.*

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### Extent of Coliform Die-Away

The population of the coliform group of bacteria, the common presumptive indicator of domestic sewage contamination, is frequently subject to drastic change during the early hours of its exposure to a new and foreign environment. A review of available literature on the subject of survival of enteric bacteria in sea



water (1, 2), reveals a few sources of information as to the extent of early die-away or growth in sea water samples.

For example, the experiments of Beard and Meadowcroft (3) indicate *Escherichia coli* mortalities in the waters of San Francisco Bay of about 68 percent in 0.8 days and 90 percent in 3.5 days.

Ketchum and his associates (4), and later Vaccaro and his co-workers (5), showed reductions of *E. coli* inoculations as great as 90 percent in raw Vineyard Sound water stored for 24 hours in laboratory containers at room temperature.

Williams (6) likewise noted considerable reduction in *E. coli* inoculums in natural sea water stored in the laboratory. He reported an average mortality of 90 percent in 25 hours. In samples of sewage suspended in dialysing tubing in the natural environment the coliform group of organisms suffered a 90 percent mortality in 25 hours although in a few cases growth was experienced.

Nusbaum and Garver (7) observed high mortalities of coliforms in laboratory tests, as great as 65 percent in 24 hours, but generally they noted growth rather than die-away in dialysing tubing suspended in San Diego Bay. Coliform survival curves representative of the observations of several of these investigators are shown in the figure.

Several experiments of mine on samples taken from Elliott Bay, Wash., near a large outfall discharging untreated sewage, showed mortalities up to 74 percent in 8 hours of storage. In experiments with a water sample taken from Budd Inlet, a salt water branch of Puget Sound which forms the harbor for Olympia, Wash., coliform die-away was 56 percent in 10 hours at a storage temperature of 20° C. A similar sample held for the same period at 3° C. showed a 38 percent reduction in coliform population. Samples prepared from dilutions of settled sewage and Pacific Ocean water collected off San Francisco showed mortalities as great as 92 percent in 24 hours at 30° C. and 68 percent at 21° C., with no significant change at 5° C.

The presence of organic nutrients may tend to offset bacterial die-away, but without refrigeration growth may occur in the early hours

of storage. For example, the addition of lactose broth to a series of samples stored at 20° C. resulted in large increases in population during the first 24 to 48 hours of storage. A period of rapid die-away followed, but die-away occurred only after a substantial lag period. The magnitude of the initial rise, the length of the lag period, and the time for 90 percent mortality were all directly proportional to the concentration of nutrient added. The survival curve for one of these tests (120 p.p.m. lactose broth) also is shown in the figure along with the results of other experiments.

### Die-Away Formulation

The figure illustrates certain similarities among the coliform survival curves obtained by different investigators. For example, each curve shows a characteristic logarithmic decrease phase with a slightly varying slope. Several curves, especially those in which growth occurred in the early stages of exposure, show a lag period before the onset of logarithmic decrease. And those experiments for which the data are sufficiently extensive indicate a resistant phase exemplified by a decreasing rate of decrease and the survival of a few coliforms for comparatively long periods of time. The decrease in bacterial numbers after an initial lag is perhaps best expressed by Click's law (8, 9), which may be written in the following form:

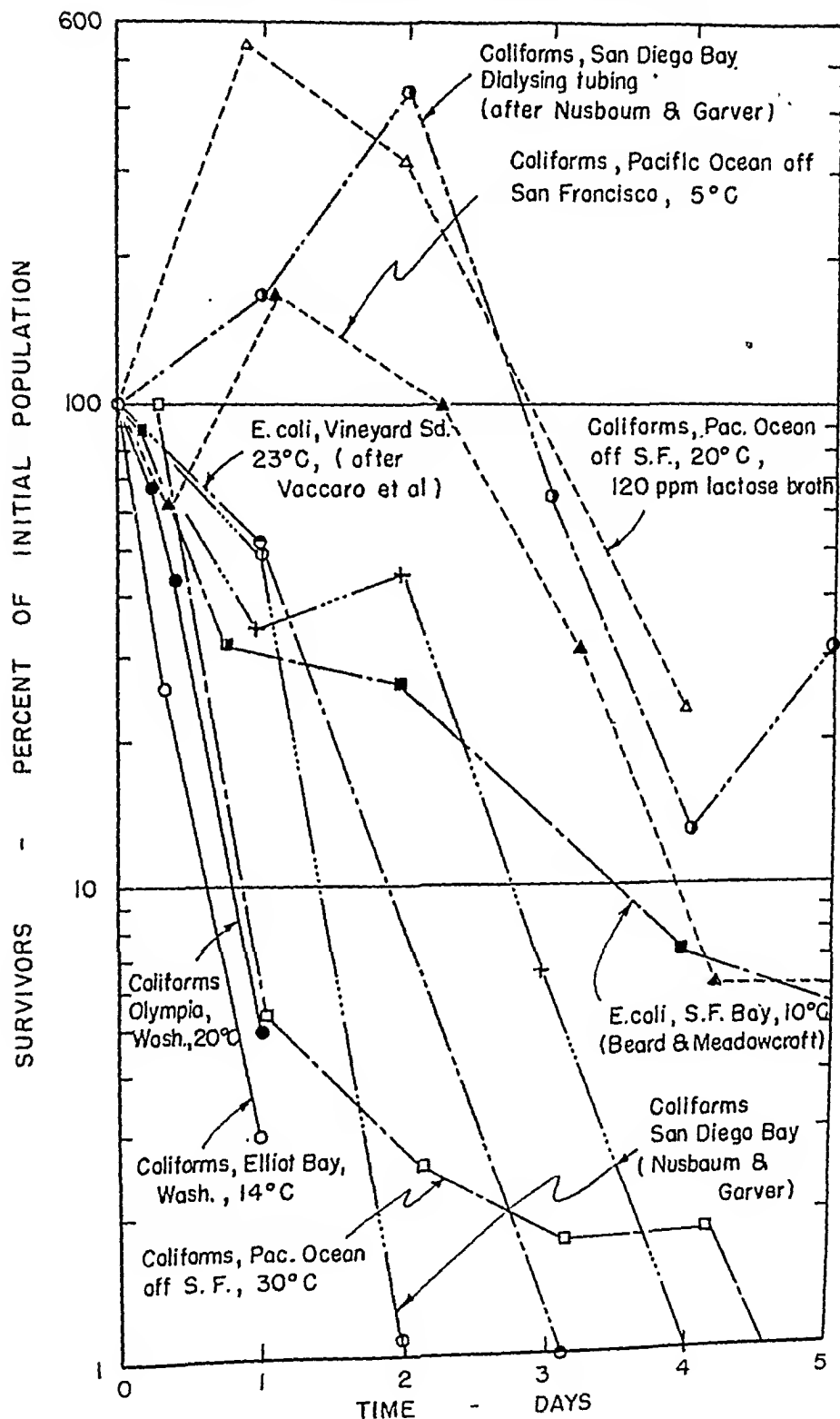
$$\frac{N}{N_0} = 10^{-k(t-t_0)}$$

$N$  is the number of survivors after time  $t$ , in days;  $N_0$  is the initial bacterial population;  $t_0$  is the lag period before logarithmic decrease, and  $k$  is a constant.

### Field Inoculation Technique

The State of Washington Pollution Control Commission, with due concern for the validity of bacteriological survey results on ocean and brackish waters, has adopted the practice of field inoculation at the site of sample collection in an effort to minimize bacterial die-away or multiplication during transport to the laboratory. This procedure, of necessity, requires that the inoculation be made directly into cold nu-

# Coliform Survival in Sea Water Samples



tempered media and that the inoculated tubes suffer the delay between sample collection and incubation normally experienced by the raw sample. This practice, while not representing the ideal condition for the preservation of the original bacteria in a viable state, does provide a better chance for an analysis truly representative of "on site" conditions.

The constant  $k$ , sometimes referred to as the coefficient of death rate, is indicative of the rate of bacterial die-away. It may be expressed as the reciprocal of the time in days required to achieve a 90 percent mortality of the initial number of bacteria when due account is taken of the initial lag period. It is generally greatest at high temperatures and during the summer months. Typical values of  $k$  range from about 0.3 (Beard and Meadowcroft, see figure) to 1.6 (my experiments at Elliot Bay, see figure). The majority of values fall between the limits 0.6 and 1.2.

The significance of the coefficient of death rate in terms of bacterial die-away during sample storage is best illustrated by a simple example. If it is assumed that  $k$  has an average value of 1.0 and that there is no appreciable lag, the number of coliforms remaining after 6 and 24 hours' exposure would be, according to the equation, respectively, 56.3 percent and 10 percent of the original population.

If a lag period occurs, the sample usually experiences some growth rather than a decrease in population. In either case the bacteriological analysis, unless performed immediately at the site of sample collection, will yield unsatisfactory results. The obvious advantages of refrigeration, where it can be conveniently employed to suppress both bacterial growth and bactericidal activity, cannot be depreciated. It must be acknowledged, however, that under conditions of routine sample collection adequate refrigeration is not readily available. Moreover, when the bactericidal effect of sea water is strong, refrigeration may be somewhat less than satisfactory.

To determine whether or not a preliminary period of 5 to 6 hours in cold media would have any appreciable effect on the viability of bacteria, we compared the cold media inoculation procedure statistically with the tempered

media inoculation procedure representative of the best possible practice.

First, from a single sample of settled sewage diluted 1:2,500 in tap water, we prepared twenty 1:10 dilutions in sterile water. Then, we divided the 20 samples into 2 groups of 10 each in order of initial inoculation, placing the odd numbers in group A and the even numbers in group B.

Working alternately from one group to the other, we inoculated all 20 samples according to the standard inoculation procedure and completed the test by confirmation on brilliant green bile broth. All inoculations consisted of five 1-milliliter portions in each of at least 3-decimal dilutions.

**Table 1. Comparison of tempered media and cold media inoculation techniques**

Sample <sup>1</sup>	Most probable number coliform organisms per 100 ml.	
	Group A <sup>2</sup>	Group B <sup>3</sup>
1.....	3,300	1,700
2.....	7,900	2,300
3.....	3,300	3,300
4.....	2,300	4,900
5.....	7,900	4,900
6.....	3,300	4,600
7.....	2,300	2,300
8.....	2,200	2,300
9.....	1,700	3,300
10.....	2,200	4,900
Arithmetic mean.....	3,640	3,450
Standard deviation.....	1,910	1,170

<sup>1</sup> 1:2,500 dilution of settled sewage in tap water.

<sup>2</sup> Inoculated immediately into tempered media (37° C.) and incubated.

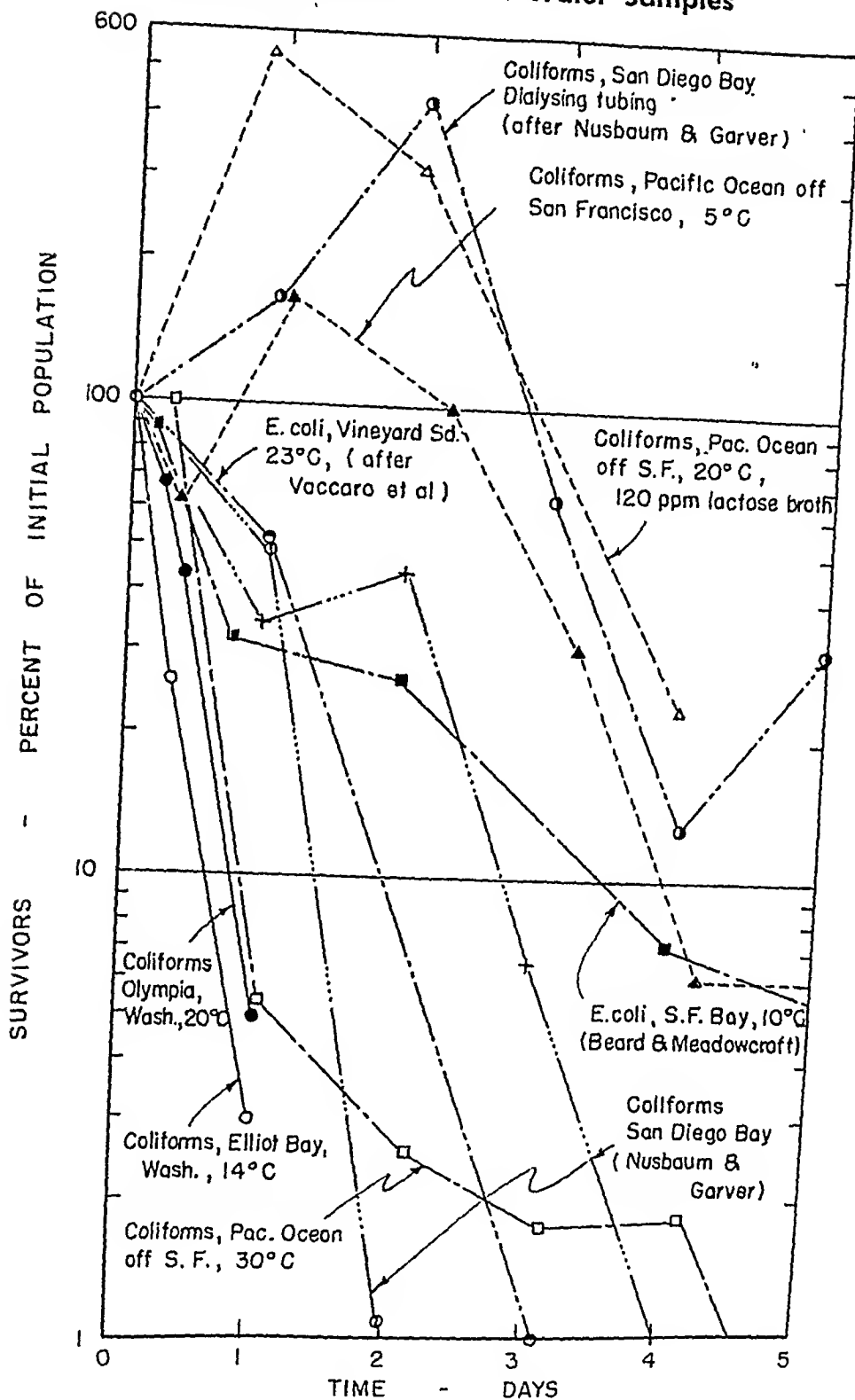
<sup>3</sup> Inoculated immediately into cold media (23° C.). Stored 6 hours at 23° C., then incubated.

We analyzed group A samples in standard strength lactose broth tempered to 37° C. before inoculation, and immediately after inoculation placed the samples in the incubator.

We examined group B samples in the same media but at a temperature of 23° C., and then stored the samples for 6 hours at the same temperature before incubating them at 37° C.

The results of this experiment (table 1) revealed no significant difference between the two procedures. In fact, the spread in individual

# Coliform Survival in Sea Water Samples



Medium for storage and analysis of sample	Most probable number of coliform organisms			Percent of samples with MPN greater than 1,000	Probability that difference from control is due to chance alone <sup>4</sup> (percent)
	Range	Mean	Anthracine tween	Geometric mean	
Series A (control) <sup>1</sup>	230-5,100	1,025	1,525	990	50
Series B <sup>1</sup>	230-3,500	790	1,067	970	13
Series C <sup>1</sup>	130-1,700	490	714	592	36
Series D <sup>1</sup>	220-2,100	175	360	647	36

The analysis in each series from the same original specimen.

<sup>1</sup> Null hypothesis. See reference 10.

Same series identified in text and in table 2.

<sup>4</sup> No significant difference.

<sup>5</sup> Significantly different.

<sup>6</sup> Significant difference questionable.

od. We inoculated each sample after storage into tempered media, and then incubated it in the customary fashion. We used 5 portions of decimal dilutions from each sample to determine the most probable number (MPN) of coliform organisms per 100 ml. of the original sample. A summary of the results of these tests is given in table 3.

These experiments indicate that bacterial numbers during storage, even for comparatively short periods, may seriously affect the interpretation of survey results. It is particularly significant that, even though one series (series D) of samples was refrigerated, an appreciable reduction in bacterial numbers occurred in this series. As we expected, the least population change occurred in the portion of the original sample that was stored at normal air temperature before inoculation. This observation is in accord with the results of laboratory studies performed on Pacific Ocean water collected near San Francisco in which bactericidal rates were observed to be directly proportional to temperature, and refrigeration was found to induce an appreciable lag prior to die-off (2).

Application of the "null hypothesis" (10) in testing the significance of the differences in values given in table 3 indicates a comparatively small probability that the differences between the mean of the control series A and the mean of either series C or series D could have resulted from chance alone. However, when this statistical test is used to com-

pare series B, the cold media inoculations, with the control series (series A), the difference is not statistically significant. It is readily apparent that when the bactericidal effect of sea water is high a comparatively short delay in inoculation into media, even cold media, may produce a much different picture of contamination than that actually existing at the time of sampling. Even refrigeration of the samples may not be sufficient to arrest bactericidal action although this practice is undoubtedly much superior to storage of the sample at normal air temperatures.

### Summary and Conclusions

Changes in populations of coliform bacteria in contaminated sea water during the early hours immediately following collection of the sample may have a significant bearing on the interpretation of the results of bacteriological surveys. Refrigeration of samples, although generally recommended when extended storage of samples is necessary, is not always capable of minimizing the bactericidal effect of sea water. Direct inoculation of the sample into cold media at the sampling site, with a 5- to 6-hour delay in incubation, produces results which are generally comparable with direct inoculation into tempered media followed by immediate incubation. This method is used by the State of Washington Pollution Control Commission and is recommended for general use on bacteriological surveys of sea water.

observations indicated by the standard deviation from the mean was actually less, though not statistically significant, in group B (cold untempered media) than in group A (tempered media).

To illustrate the effect of short-term changes in bacteria populations in sea water samples and to test the applicability of several storage and handling techniques, we conducted a special series of experiments during an actual bacteriological survey of Budd Inlet, Wash.

We made 14 examinations of the coliform content of the water near a single survey station off the port of Olympia, Wash., from September 1951 through May 1952.

The samples were collected under the wide variety of conditions that would be encountered on any routine field survey. The harbor at Budd Inlet received the untreated sewage discharge from the city of Olympia throughout the 9-month survey period. In addition, the inlet provided the egress for runoff of an extensive area drained by the Deschutes River. A combination of runoff, waste discharge, tidal fluctuation, and climatic variations provided

considerable variety in salinity, temperature, amount of dissolved oxygen, and organic content. A summary of individual survey observations is presented in table 2.

We examined each of the samples collected at the survey station by four distinctly different procedures. Immediately after collection of the sample, an inoculation was made into tempered (37° C.) lactose broth as well as into cold media. The temperature of the cold media was close to that of the surrounding air (13°-23° C.). The tempered media series (series A) was incubated without further delay at 37° C. and served as a control for evaluation of the other techniques. The samples in the cold media series (series B) were held at air temperature for periods ranging between 5 and 6 hours before inoculation into tempered media, the time corresponding to the maximum delay between collection of field samples and inoculation into media in the laboratory. The samples were then incubated at 37° C.

We divided the original sample into two portions. One (series C) we stored at normal temperature for 5 to 6 hours, and the other (series D) we refrigerated at 6° C. for a si-

Table 2. Survey observations for State of Washington Pollution Control Commission sampling station, Budd Inlet, Olympia, Wash., 1951-52

Sample	Date	Range of water storage temperature (degrees centigrade)		Storage time (hours)	Dissolved oxygen (p.p.m.)	Biochemical oxygen demand (p.p.m.)	Salinity (p.p.m. NaCl)	Most probable number coliform organisms per 100		
		Low	High					A <sup>2</sup>	B <sup>3</sup>	C <sup>4</sup>
1	9-11-51	19.8	21.1	4.8	9.7	3.0	21,300	3,500	2,100	190
2	9-26-51	15.0	23.0	5.6	9.8	5.5	28,500	300	190	190
3	10-1-51	11.7	19.8	4.8	7.1	2.2	25,000	1,300	2,400	790
4	10-10-51	11.5	19.2	5.0	6.7	2.9	26,000	5,100	2,100	1,700
5	10-19-51	13.0	19.0	5.0	6.1	1.1	21,500	3,500	3,500	1,300
6	10-30-51	10.9	20.3	5.0	6.1	1.4	21,800	1,300	1,400	1,300
7	12-12-51	7.7	13.0	6.0	9.2	1.9	11,100	950	790	330
8	1-9-52	6.9	21.4	5.0	8.9	2.6	26,100	490	490	330
9	1-21-52	6.6	11.0	5.8	8.7	.7	25,100	330	490	130
10	2-4-52	7.4	23.3	5.2	9.1	2.7	21,900	3,500	3,500	1,100
11	2-27-52	7.1	17.7	5.2	9.2	1.1	12,500	1,100	790	1,300
12	3-18-52	7.9	16.3	5.0	9.5	1.5	21,900	230	230	330
13	4-29-52	11.0	17.0	5.1	10.7	3.0	28,200	330	330	330
14	5-29-52	14.0	17.0	5.3	10.0	3.1	26,400	490	490	190

<sup>1</sup> Dissolved oxygen consumed during 5 days' incubation of water sample in the dark at 20° C.

<sup>2</sup> Series A (control series). Inoculation into tempered media (37° C.) immediately after collection; stored 5-6 h

<sup>3</sup> Series B. Inoculation into cold media (storage temperature) immediately after collection; then incubated before incubation at 37° C.

<sup>4</sup> Series C. Stored 5-6 hours at indicated temperatures before inoculation into tempered media, then incubated at 37° C.

<sup>5</sup> Series D. Refrigerated 5-6 hours at 6° C. before inoculation into tempered media, then incubated at 37° C.



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## technical publications

### A Digest of State Enabling Legislation for Mosquito Abatement Through 1955

*PHS Publication (unnumbered).*  
1956. 83 pages.

This publication covers the laws on mosquito abatement in existence in 24 States. It is intended to provide the basis by which State and local groups responsible for such activities can evaluate or compare their existing legislation or acquire the context and terminology for drafting new legislation; to provide the procedures for initiating, directing, and operating a program; and to provide Federal and State officials with basic information for planning and coordinating these activities.

The codification for each law includes the following: legislative history, authorization and procedures for formation, boards of control and their powers and duties, guidance and coordination, financing, annexation, consolidation, and penalties. Also included in the publication is a summary table on financing.

Copies of this booklet can be obtained from the Communicable Disease Center, Public Health Service, Atlanta 23, Ga.

### Careers in Mental Health

*PHS Publication No. 23. Revised 1956. 19 pages; illustrated. 20 cents.*

The 1956 revision of this pamphlet lists the current level of stipends available under Public Health Service traineeships for individuals training in psychiatry, psychiatric nursing, clinical psychology, and psychiatric social work. The pamphlet describes general professional opportunities in the mental health field and contains information about training opportunities for such employment.

Each major professional area is

described, and the horizons for personal and professional development are outlined. Listed are the qualifications, educational requirements, and potential earnings. The pamphlet tells where additional information about each profession and necessary course of study may be obtained.

The pamphlet is intended for high school and college students who are planning a career and are interested in working with people. It is also useful for guidance and counseling personnel.

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